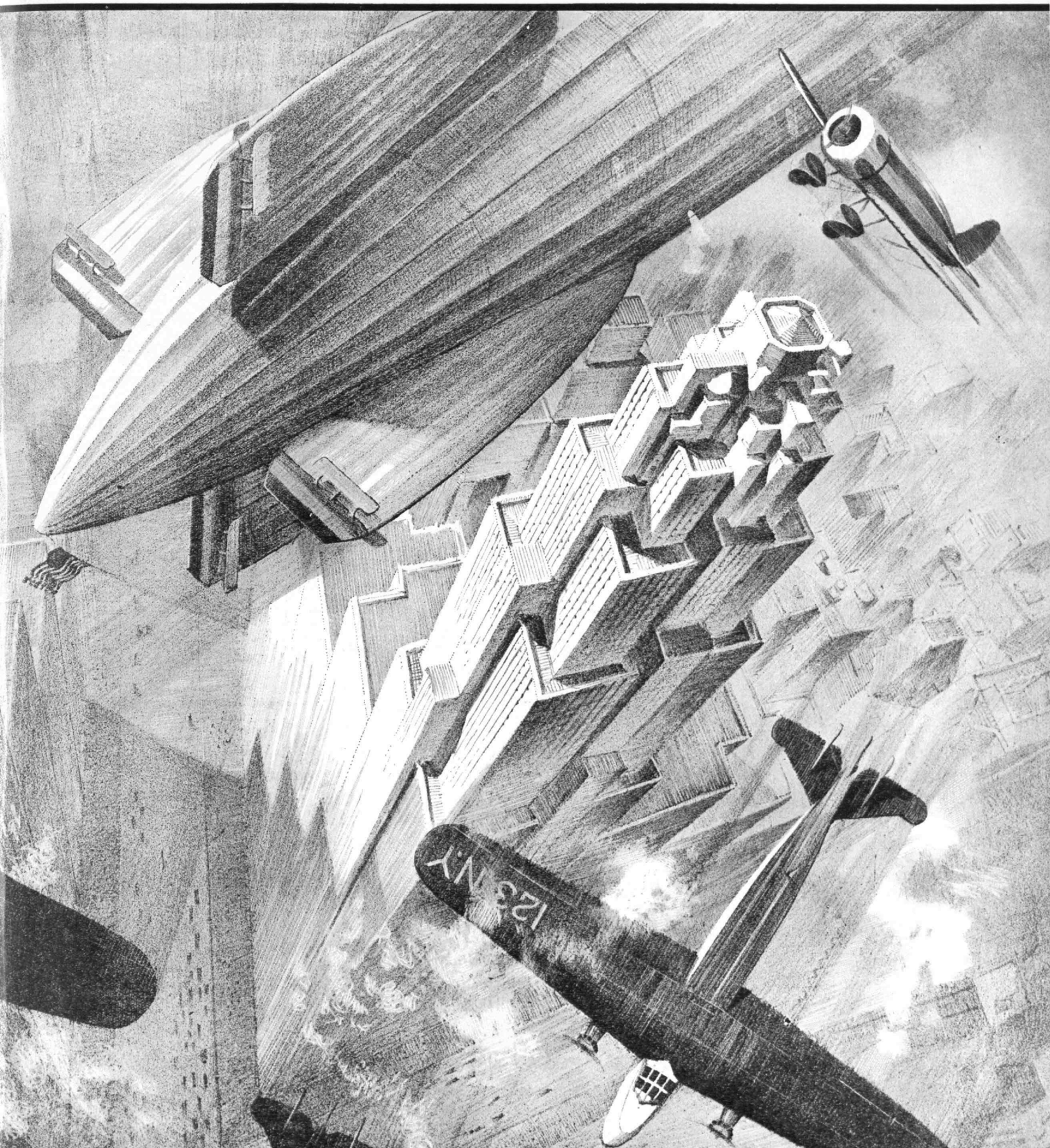
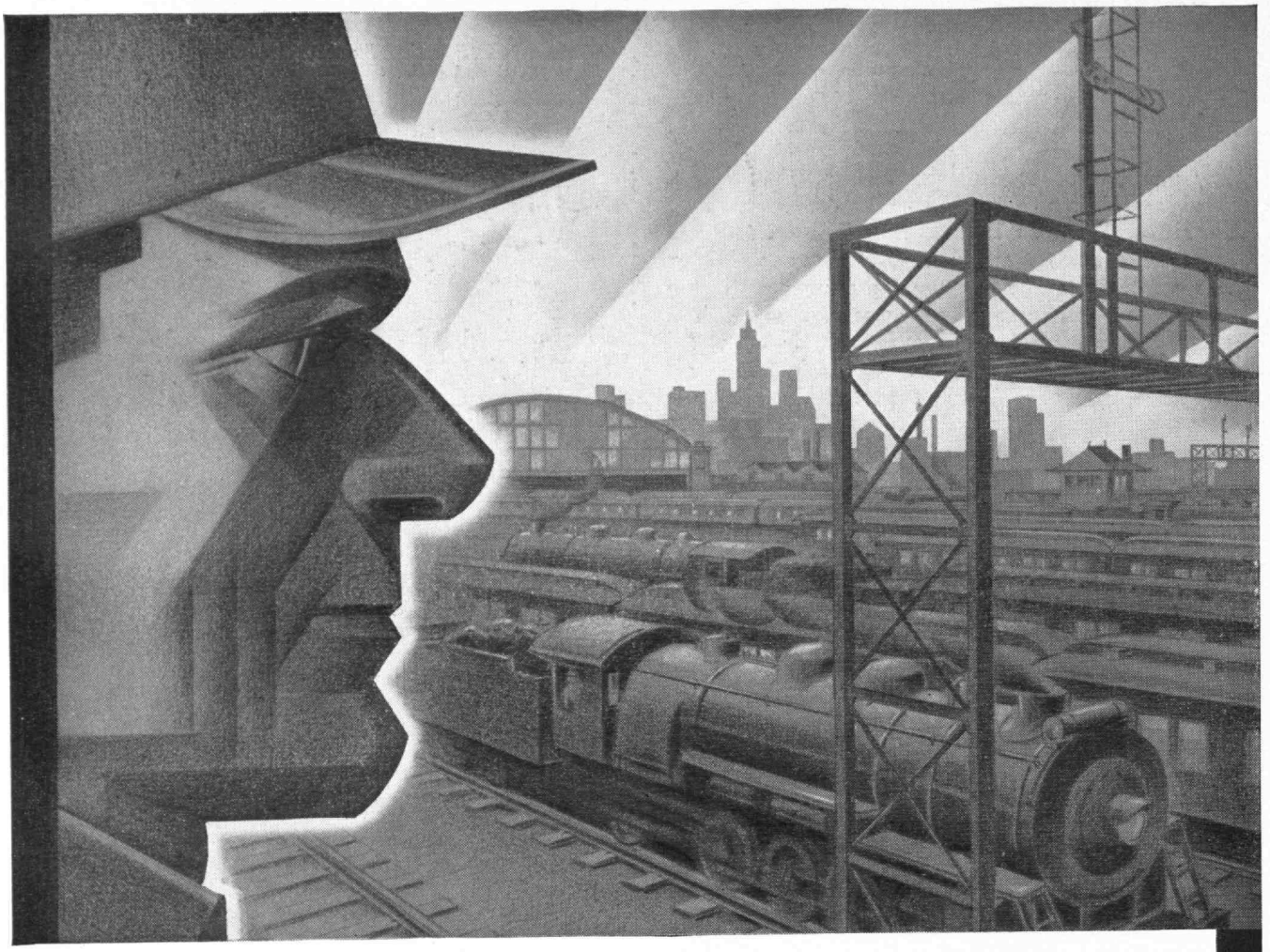
February 1932

TECHNOLOGY REVIEW



technology
review
Published by MIT

This PDF is for your personal, non-commercial use only.
Distribution and use of this material are governed by copyright law.
For non-personal use, or to order multiple copies please email
permissions@technologyreview.com.



GRINDING and modern rail transportation closely allied industries

RAILROAD « » « »

In 1830 — thirteen miles of railroad.

Today — 251,000 miles within the United States, employing 1,750,000 people.

Arteries of steel that link the nation into a commercial whole.

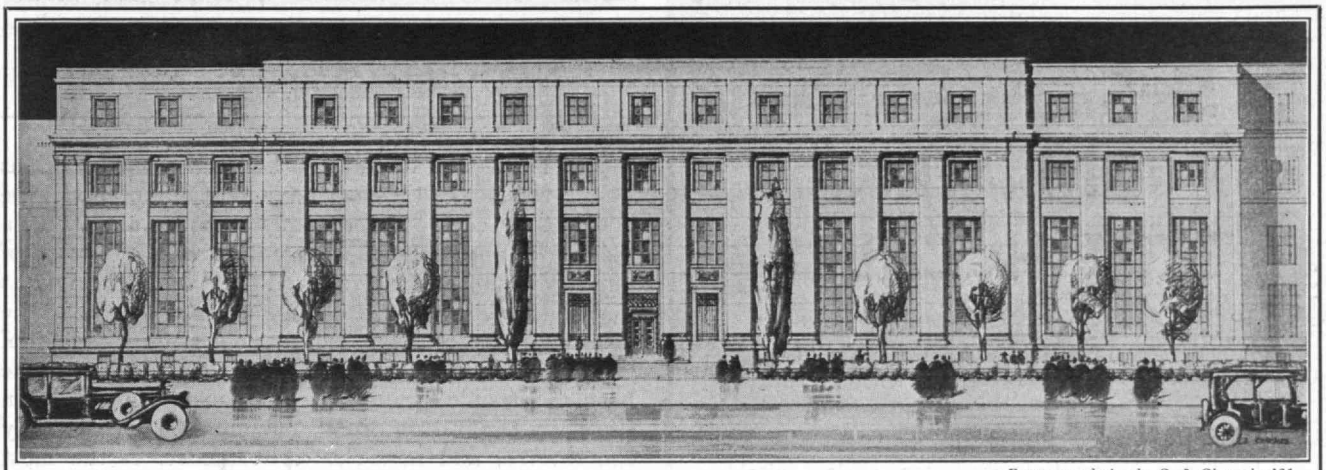
Steam and electric locomotive parts — car wheels and the modern anti-friction bearings — frogs and switches of super-hard manganese steel — electrical signaling and lighting apparatus — in the manufacture of these and countless other equipment essential to modern railway operation Grinding plays its part — Grinding Wheels and Grinding Machines by Norton Company, Worcester, Mass.

NORTON

Grinding Wheels . . . . Abrasives for Polishing
. . . . Abrasive Aggregate . . . . Floor and Stair Tile . . . .
Grinding and Lapping Machines . . . . Refractories
. . . . Porous Plates . . . . Pulpstones . . . .

Great Industries No. 7

THE TECHNOLOGY REVIEW, February, 1932. Vol. XXXIV, No. 5. Published monthly from October to May Inclusive and in July at 10 Ferry Street, Concord, N. H. Publication date: twenty-seventh of the month preceding date of issue. Annual subscription $3.50; Canadian and Foreign subscription $4.00. Entered as second-class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879.



From a rendering by C. J. Chamales '31

Electrical Installation in The George Eastman Research Laboratory

by

LORD ELECTRIC COMPANY, INC.

Electrical Contractors

301–303 COLUMBUS AVENUE · BOSTON

Other Offices in

NEW YORK PITTSBURGH HARTFORD

FREDERIC W. LORD '93, *President* THOMAS P. CURTIS '94, *Vice-President*

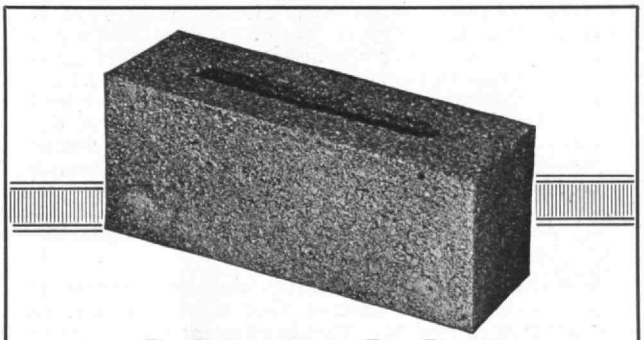
F B&D

M. I. T. MEN

H. V. Coes - - - - '06
E. S. Coldwell - - '15
S. J. Cole - - - - - '26
J. A. Emery- - - - '93
Page Golsan - - - '12
J. F. Greene - - - '07
F. K. Merriman - '04
G. I. Rhodes - - - '05
W. T. Smith '21 & '22
A. A. Uebelacker - '18
R. P. Westerhoff - '27
H. E. Whitaker - - '09
J. E. Woodbridge - '93

Design
Construction
Management
Reports

Ford, Bacon & Davis, Inc.
Engineers
39 Broadway, New York City
Philadelphia Chicago San Francisco



CINUCOR
MASONRY UNITS

They are light, tough and strong. Used where fire safety, sound proofness and insulation are desired.

CINUCOR units are used for all types of construction and are made in various sizes.

Write for "CINUCOR MANUAL"

CINDER CONCRETE UNITS CORPORATION
BOSTON, MASSACHUSETTS

PLANT
East Somerville
Phone SOMerset
2754

OFFICE
201 Devonshire St.
Phone HUBbard
1733-1734

5 Features of SIMPLEX TYPE H CABLE

Type H Cable is especially suited to high voltage cable systems that are Y-connected with neutral solidly grounded. Following are a few of its advantages:

1. Control of Temperature

In Type H multiple-conductor cable, suitable metallic coverings, such as copper tapes, surround each insulated conductor and conduct the heat generated in the conductors and insulation to the outer sheath so effectively that the temperature in the center of the cable is practically the same as that of the outer sheath. This reduces the thermal resistance from conductors to sheath and keeps the insulation at a lower maximum temperature and a lower average temperature.

2. Avoidance of Tangential Insulation Stresses

The conductor sheaths in Type H cable eliminate tangential stress and, therefore, remove one of the greatest difficulties of multiple-conductor cable for higher voltages.

3. Elimination of Voids

In lead-covered cable there are often voids or air spaces between the surface of the insulation and the inner surface of the sheath in which ionization may start, even at a low voltage stress. With Type H cable, the sheath over each individual insulated conductor is closely applied and is so constructed as to continue to adhere to the surface of the insulation regardless of the deformation of the lead sheath. Consequently, there is less liability of the formation of voids. Any voids outside the conductor sheaths, not being under electrical stress, cannot become ionized.

4. Assurance that Faults will be Conductor-to-Ground.

The absence of belt insulation and the presence of conductor sheaths insures that all faults will be conductor to ground. This is of great advantage to the operating man, particularly on systems with neutral ground resistance or with ground relays.

5. Thorough Impregnation of Paper Insulation

The conductor sheaths in Type H cable are so constructed as to allow free impregnation of the insulation. The area of the perforations in the conductor sheaths are entirely adequate for this purpose and yet there is no loss of the other advantages such as decreased heating, elimination of tangential stresses, increase in sheath resistance, etc.

Further information will be sent upon request.

SIMPLEX WIRE & CABLE Co

MANUFACTURERS

79 SIDNEY ST., CAMBRIDGE A, BOSTON

NEW YORK PHILADELPHIA CLEVELAND
JACKSONVILLE CHICAGO SAN FRANCISCO

THE TABULAR VIEW

CITY planning in America has undergone a curious inversion. In the early days most of our cities were laid out by civil engineers, of whom L'Enfant was a notable example. At the present time, a majority of our city planners have received their basic training as building architects or landscape architects, mostly the latter. Engineers have worked on single aspects of municipal planning problems, but few of them have been responsible for integrated regional planning. ¶ In Germany the history of city planning has been exactly the reverse, and now the civil engineer is the most important figure in regional planning there. It may be noted, by way of parenthesis, that there is an indication that the American civil engineer is looking toward a more active participation in this field. The Department of Civil Engineering here at the Institute, for example, is interested in the planning of airports, an activity that is now paradoxically in the hands of the architect and landscape architect. ¶ ROMAN F. HEILIGENTHAL, the author of the article on German city planning on page 199, symbolizes in his person the state of affairs in Germany. He is one of the foremost city planners in that country, although by profession he is a civil engineer. He is chairman of the Department of Civil Engineering at the Technical University at Karlsruhe, and holds doctorates in both engineering and economics. In his capacity of city planner, he teaches the subjects of city planning and city engineering, is a member of the German Academy of Town Planning, the American Civic Association, the International Federation for Housing and Town Planning, consultant for the cities of Berlin, Essen, Düsseldorf, Breslau, Wetzlar, Rostock, and he was formerly town planning official for the city of Berlin. In addition to all these activities, he has published various treatises on city planning; notably, *Deutscher Städtebau* (1921), *Berliner Städtebaustudien* (1926), and *Städtebaurecht und Städtebau* (1929). It is obvious that Dr. Heiligenthal speaks with great authority, and his doctrine that the engineer should play a prominent part in city planning will doubtless fall on fertile ground in America. ¶ His article was translated from the German by HUNTER ROUSE, '29, who recently returned to this country after holding an M. I. T. Traveling Fellowship in Hydraulics. He will be remembered as the author of an article entitled "Amerikanismus" in the December, 1930, Review. Another article by him on one of the great German hydraulic laboratories is to appear in a forthcoming issue, as well as two other translations of articles by notable German engineers on the social importance of their profession in the Fatherland.

TWO articles in this issue are contributed by Dr. NORBERT WIENER, a contributing editor of The Review, who is now lecturing at Cambridge University, England, and in his spare time visiting and traveling on the Continent. His article on page 201 throws a new and

(*Concluded on page 195*)

THE TABULAR VIEW

(*Concluded from page 194*)

revealing light on the mysteries of modern physics, while his monthly letter from abroad (page 218) records his impressions of conditions among the intellectual classes in Europe under the trying conditions of unrest and uncertainty that now prevail. ¶ Gottfried Wilhelm Leibniz, who evolved some astonishingly modern physical concepts as Dr. Wiener points out in his main article, is growing in stature as a scientist, although dead more than 200 years. Last month The Review, in describing the differential analyzer developed by Dr. Vannevar Bush, '16, noted that Leibniz was probably the first to visualize the usefulness of machine computation. In a notable paper on the differential analyzer which Dr. Bush published in the *Journal* of the Franklin Institute, he paid tribute to the foresight and brilliance of this great German philosopher, scientist, and mathematician. ¶ Last month The Review began with an article by Dr. Ralph E. Freeman a series of papers on current economic and business problems. The series is continued in this issue with five papers prepared by members of the Institute's Department of Economics and Statistics, and of Business and Engineering Administration. As explained in the editorial note at the beginning of this group of papers, they were originally presented at a conference held for graduates of the latter named department. Next month, there will be another full length article by Robert F. Elder, Professor of Marketing at the Institute. The Review wishes to express its appreciation to the aforementioned departments at the Institute for making these studies of economic and business conditions available for publication. It is the wish of both The Review and these departments that they will contribute to an understanding of the "economic disease from which we are suffering" and may suggest curative procedures. ¶ Registrar JOSEPH C. MACKINNON, '13, author of the article on electrical engineering graduate instruction, joined the Institute staff as assistant in physics in 1915, after having spent the two years following his graduation in engineering work. In 1918 he became an instructor in physics, and in 1921 a member of the Faculty. He has been Registrar of the Institute since 1923.

AS a result of the last football season, there has been widespread discussion of college athletics and their effect upon the health of the participants. Most of this discussion has been cursory and uninformed and there is the need for a thorough and impartial investigation of the facts. The article on page 209, happily, fills this need. It is a thoroughgoing study, from the point of view of the physician, of the medical literature on the subject of athletics and health. Its author, Dr. ALLAN W. ROWE, '01, hardly needs an introduction. As director of the Evans Memorial of the Massachusetts Memorial Hospitals, and as Secretary of the Institute's Alumni Advisory Council on Athletics, he is thoroughly informed on every phase of the problem.

A good workman needs good tools to produce at his normal capacity. Large plants devote much time and expense to tool selection. Good tools are an important influence on the cost of every job.

Use Catalog No. 31 as a reference book and guide in selecting good tools. Copy sent on request. Brown & Sharpe Mfg. Co., Providence, R. I.

B·S

Brown & Sharpe Tools

"World's Standard of Accuracy"

BAUSCH & LOMB FOR PRECISION

AMERICA'S industrial leadership is based largely on interchangeable standard parts. The Bausch & Lomb Contour Measuring Projector is America's dependable aid in securing accuracy of parts well within the established limits.

BAUSCH & LOMB OPTICAL COMPANY
ROCHESTER · NEW YORK

HE BELIEVES IN KEEPING UP THE PLANT

TUNE IN:
Goodyear invites you to hear John Philip Sousa and his Band ... Arthur Pryor and his Band ... Revellers Quartet and Goodyear Concert-Dance Orchestra ... every Wednesday and Saturday night, over N.B.C. Red Network, WEAF and Associated Stations

THE G.T.M.—Goodyear Technical Man—is just as much interested in the proper maintenance of mechanical rubber goods operating efficiency as he is in their original specifications.

He realizes that the proud record of Goodyear Mechanical Rubber Goods—equipment which he himself has specified—is his best reference in seeking further opportunities to extend his work.

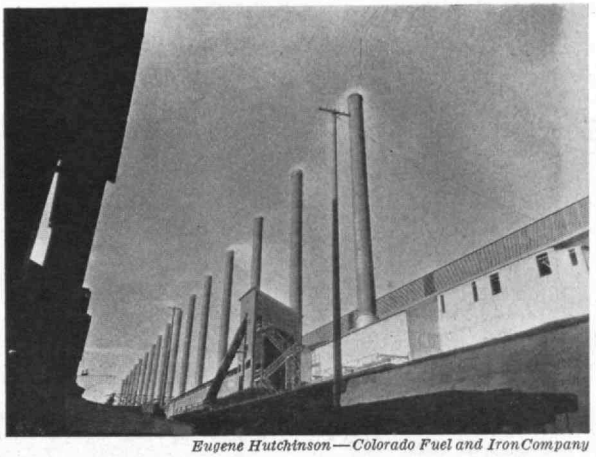
Therefore, the G. T. M. is a regular visitor, or inspector rather, in plants that use Goodyear Belts, Molded Goods, Hose and Packing. He is quick to cooperate with plant officials in correcting neglect or misuse, or to provide for renewals in ample time to save costly delays when equipment must be replaced.

Let the G. T. M. serve as a member of your maintenance staff. What he knows about rubber and its practical application in scores of industries may mean very appreciable savings in time and money in your plant. Why not discuss plant operations with him now? Just write to Goodyear, Akron, Ohio, or Los Angeles, California, and ask the G. T. M. to call.

THE GREATEST NAME IN RUBBER

GOODYEAR

BELTS • MOLDED GOODS • HOSE • PACKING



Eugene Hutchinson—Colorado Fuel and Iron Company

THE TECHNOLOGY REVIEW

A NATIONAL JOURNAL DEVOTED TO SCIENCE, ENGINEERING, AND THE PRACTICAL ARTS

Edited at the Massachusetts Institute of Technology

VOLUME XXXIV NUMBER 5

Contents for February, 1932

Editor
J. RHYNE KILLIAN, JR.

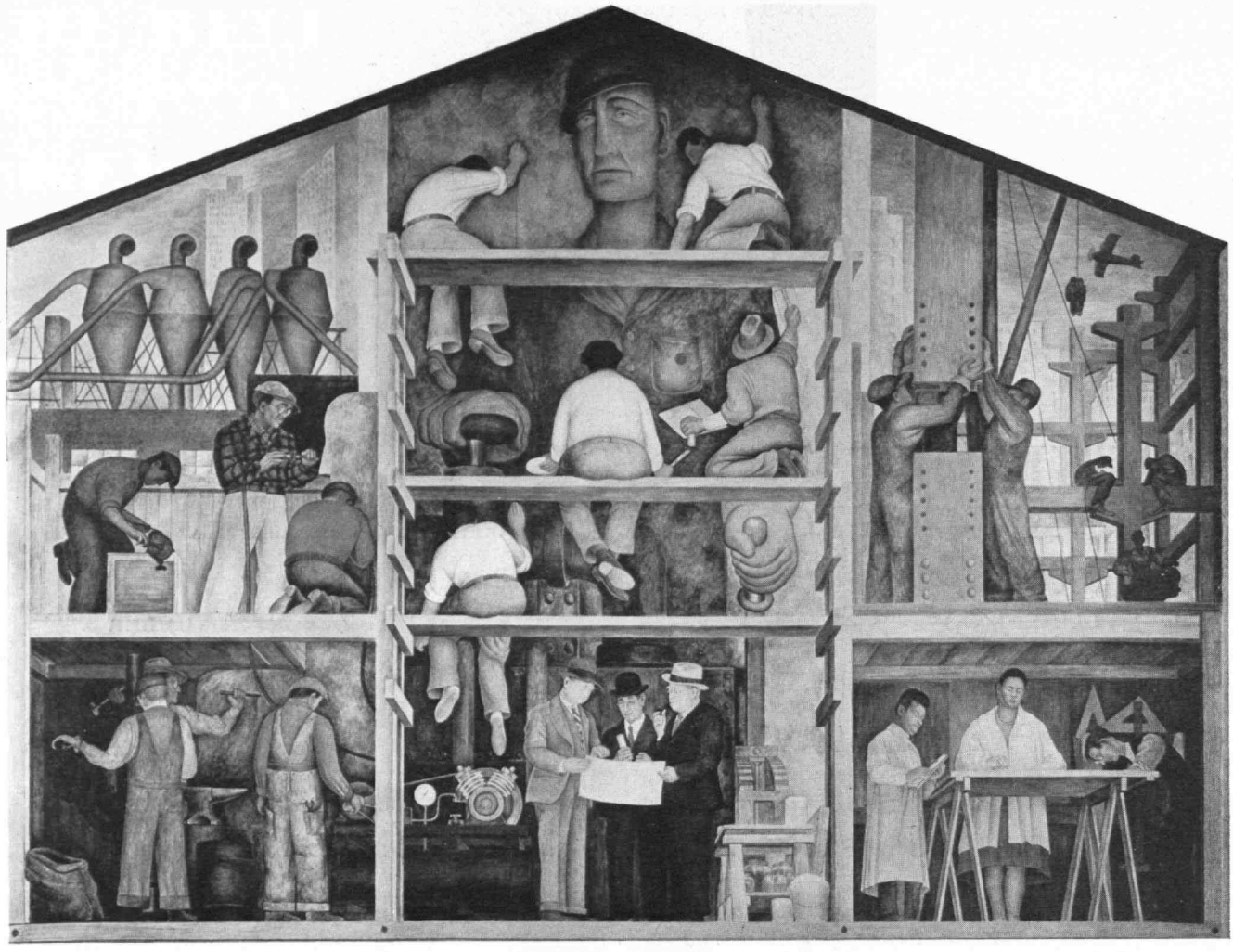
Publisher
HAROLD E. LOBDELL

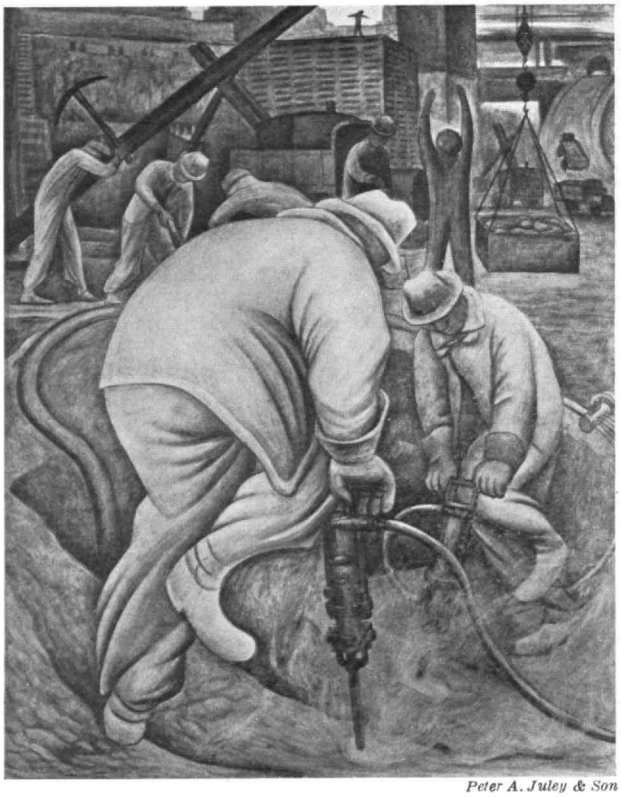
Business Manager
RALPH T. JOPE

Contributing Editor
JOHN J. ROWLANDS

PUBLISHED monthly on the twenty-seventh of the month preceding the date of issue at 50 cents a copy. Annual subscription $3.50; Canadian and foreign subscription $4.00. Published for the Alumni Association of the Massachusetts Institute of Technology. Bradley Dewey, President; George K. Burgess, Donald G. Robbins, W. Malcolm Corse, Vice-Presidents; Charles E. Locke, Secretary.

Published at the Rumford Press, 10 Ferry Street, Concord, N. H. Editorial Office, Room 11–203, Massachusetts Institute of Technology, Cambridge A, Mass. Entered as Second-Class Mail Matter at the Post Office at Concord, N. H. Copyright, 1932, by the Alumni Association of the Massachusetts Institute of Technology. Three weeks must be allowed to effect changes of address. Both old and new addresses should be given.





Peter A. Juley & Son

A MURAL (above) in the California School of Fine Arts, executed by Diego Rivera. This Mexican, whose work is mainly fresco, is plying his trade with astonishing approbation in the United States. Many of his subjects depict applied science and technology, a subject which he treats bluntly but revealingly. Left: "Pneumatic Drill," a new fresco by Mr. Rivera, which is on exhibition at the Museum of Modern Art in New York City

THE
TECHNOLOGY
REVIEW

Vol. 34, No. 5

February, 1932

ENGINEERS AS CITY PLANNERS

Germany Finds Technical Clarity a Way to Civic Beauty

By Roman F. Heiligenthal

Translated by Hunter Rouse

THAT law of nature, called recapitulation, which states that higher forms of life must, prior to birth, pass through all the stages of evolution of their predecessors, seems to hold true for the modern art of building, just showing signs of life. Such beginnings as the London Crystal Palace of 1851, the Eiffel Tower of 1888, and the numerous bridge projects in America and Europe were unable to bring this new structural art into the world, because mankind had not attained the proper degree of maturity. Civilization still had to re-experience the entire architectural development of the Egyptians, the Greeks, and the Romans, through the Gothic and Renaissance to Baroque and Classic styles, before it could finally free itself from the past.

Germany, so historic in her tendencies, has suffered greatly under this situation, not only in structural architecture but in city planning, especially since the latter was not, as in America, in the hands of the landscape architects, but in those of the building architects. The influence of city designs of the Middle Ages, felt until the end of the Nineteenth Century, and of Baroque designs till early in the Twentieth, have seriously hindered the progress of city development.

The German engineer may take unto himself credit for having guided city planning out of this erroneous situation. From the following points of attack he has approached the problem of municipal development:

1. Questions of economics, of transportation of goods, and of intercourse.

2. Matters of water, gas, and electric supply, of drainage and sewage, of the provision of tree and park areas.

3. The problem of housing the laboring forces of great industries.

The Nineteenth Century concerned itself in no way whatsoever with the city as a center of production, but instead dealt primarily with the development of residential quarters. Planning of industrial centers was looked upon as purely technical — the planning of a residential section was an art.

German engineers, depending upon their knowledge of political and private economics, first determined that the modern municipality, contrary to the earlier cities, is not a consuming center, but a producing center; that its life forces are industry and commerce; that its development is stimulated by transportation and turnover of goods; and that its entire character may be understood only through a proper understanding of its economic functions, its labor divisions, and its labor associations.

City planning may not commence with the secondary matter of residential districts; on the contrary, its primary duty is to establish the production possibilities of the locality and thereafter so to give body to the plan that these production possibilities will be fully utilized.

The means thereof lie in the transportation system; the skeleton of riverways and railways determines the figure of the modern city. This figure is subject to continuous growth and remodeling, since the modern city is no longer the economic center of a small region, but an arm of the economic world and an object of its extraordinarily far-reaching influences.

Not static as was the city of the Eighteenth Century, planned and built after a fixed design, but dynamic — thus must the modern municipal organism be understood; for its life signifies not only constant growth, but also death for many sections. Its plan must be essentially elastic.

The great designs submitted in prize planning contests for Berlin in 1910, for Düsseldorf in 1912, for Breslau in 1921, and for Wetzlar in 1925 stand as a symbol of this development. The systems of intercourse in these designs concentrate entirely upon furthering the productive processes of the city, and giving the laborers peace after the turmoil of the day.

That the commercial centers are the disturbing element in the municipal design — as taught by Romanticists and Classicists at the turn of the century — is a fallacy. On the contrary, while the Nineteenth Century sponsored the ring scheme of the old fortified towns, the radial development of the modern city was first brought about by demands of intercourse. Only as a result of the introduction of street cars in municipal traffic did the difference between thoroughfares and residential streets become apparent. Thus the modern city found that form expressive of its organization. Commerce has led the way out of the maze created by speculation and architectural fantasy and, above all, has made possible the process of crystallization of the modern city system.

In the field of street design the *Studiengesellschaft für Automobilstrassenbau* (Society for the Study of Automobile Highway Construction) has played a most prominent part. This association has evolved a plan of a network of main highways for entire Germany, which will be followed as closely as the unfortunately meager funds will permit. It has also established standard cross-sections for a multitude of different sorts of highways and streets, which are of extreme value not only for regional planning, but for city design in the narrower sense as well. It has finally proved in how high a measure the street cross-section is determined by the relation of through traffic to local traffic, which changes according to the varying agglomeration of its economic character.

Through the work of the engineers for water, gas, and electric supply as well as those for sanitation in industrial districts, regional planning has come into existence. German engineers have not only technically solved their problems of water supply and sanitation (*Imhofftanks*) but they have also stimulated the solution of these problems within the widest limits for entire economic districts and drainage regions. Finally they have also sponsored legislation favoring the progress of their efforts.

This legislation, which has made its mark upon German regional work, recognizes an association of certain groups and organizations (*Zweckverband*) based upon a special law. Unenforced coöperation of the community with technical experts serves to clarify the economic and technical bases for, and to further develop the matter in law leading to, a closer bond between these groups. Stronger regulations are considered than are necessary for the completion of projects, in order to establish firmly their various rights and duties, and to simplify relations with the courts and so obviate disputes.

In this way the great union for the water supply of the Ruhr district was created as early as 1898; the Emscher Association in 1904 for flood control, drainage, and the purification of the drained water in the Emscher region; and the Ruhr Union of 1913, which attends to these problems in the region where the collective waters of the Ruhr flow off.

This *Zweckverband*, through passage of special laws, proved itself of such merit in the Ruhr region that it has also been used for regional planning in the field of city design, for the Ruhr Settlement Union was formed in 1920, also by special law. In this case as well, the association by law was preceded by years of uncompulsory cooperation between the community and the state officials and technical experts, in order to clarify the underlying principles and work out the matter in judicial terms.

As source of this work there existed the wish to retain the recreational sections of the Ruhr district threatened by the development of industries. It soon became obvious, principally through the efforts of Dr. Ing. Schmidt, that it was not possible to rely upon the negative inertia of park spaces for their preservation, without providing positive means for the expansion of industries and for the layout of residential quarters and routes of intercourse. As a result, the Ruhr Settlement Union is armed with court authorization for the construction of traffic channels, for zoning, settlement, and the provision and preservation of free spaces.

The realization that useful economic politics are only possible if the basic principles of social hygiene are observed has led to the establishment of large planted areas even in the centers of the largest cities.

In Berlin there are expansive open spaces provided in the suburbs for drainage and gardening purposes. The sand districts of the plains of Brandenburg were transformed into irrigated lands to take up the drainage of the city and to lighten the problems of milk and vegetable supply. Adjacent to these great farming lands were provided expansive recreational fields for the community through acquisition from state and private ownership of wooded sections which surround the most beautiful scenic territory, in particular that of the lake region.

So far as these large open spaces of the community may serve tourists, they are also used to promote agriculture and forestry — but always in such a way that the goals of recreational facility and scenic beauty are first considered.

In conjunction with the large open suburban areas and the inner city parks, the example set by America in providing grass strips along street and sidewalk has had a strong influence in Germany. It has also been realized that the present-day parks may no longer be designed in the style of the fashionable court gardens of the Eighteenth Century, since they must serve huge throngs as playgrounds. These, together with sport and swimming parks, are now planned in great numbers and area.

The settling of laboring classes in expansive settlement districts has been an (*Concluded on page 222*)

BACK TO LEIBNIZ!

Physics Reoccupies an Abandoned Position

By Norbert Wiener

IT IS a commonplace of the present decade that physics is in a state of turmoil. Almost all of the grand structure which the physicists of the Eighteenth and Nineteenth Centuries reared remains standing in some form or other, but the logical foundation on which it has been erected has been undermined on all sides. We are far more confident of the validity of ordinary engineering computations, within ordinary engineering limits, than of any form of the laws of motion. The unquestioned dominance of the Newtonian physics is a thing of the past, and up to the present, no form of relativity, or quantum theory, or wave mechanics has been able to assume that logical completeness which characterized the foundations of the physics of our grandfathers.

In the present dilemma, it is very well worth while to call history to our aid and to compare the state of mind of the present period with that of other periods of doubt and confusion. This historical attitude in science, it is true, is suspect to many of our more "tough-minded" contemporaries. What does the stupid repetition of the blunders of the past, they will say, have to do with so live and growing a subject as science? Science is — or at least I imagine the up-to-date reader of outlines, symposia, and digests will claim that it is — the utter antithesis of such intellectual activities as metaphysics, which spirals around in a continual reoccupation of abandoned positions, and which has an interesting history only because it has a dead future. Science is progressive, we are told, and when it once outlives a primitive stage, that stage is past for all time. This view is held by many readers of popularized science, by most of those who proffer Mr. Einstein the keys of cities, and here and there, I am sorry to say, by some misguided *Fachbruder*.

Nevertheless, in considering the present period of intellectual chaos, I do find it profitable to return to the times before Newton, or at the very latest, to the times when Newtonian physics was itself but one alternative theory struggling for recognition. Besides Newton himself, the greatest names of this period are those of the Dutch physicist, Christian Huyghens, and of the German mathematician-physicist-philosopher-statesman, Gottfried Wilhelm Leibniz. These two scholars were in close communication with each other. As few people realize, the Leibnizian work, done largely under the influence of Huyghens, possesses a startling modernity.

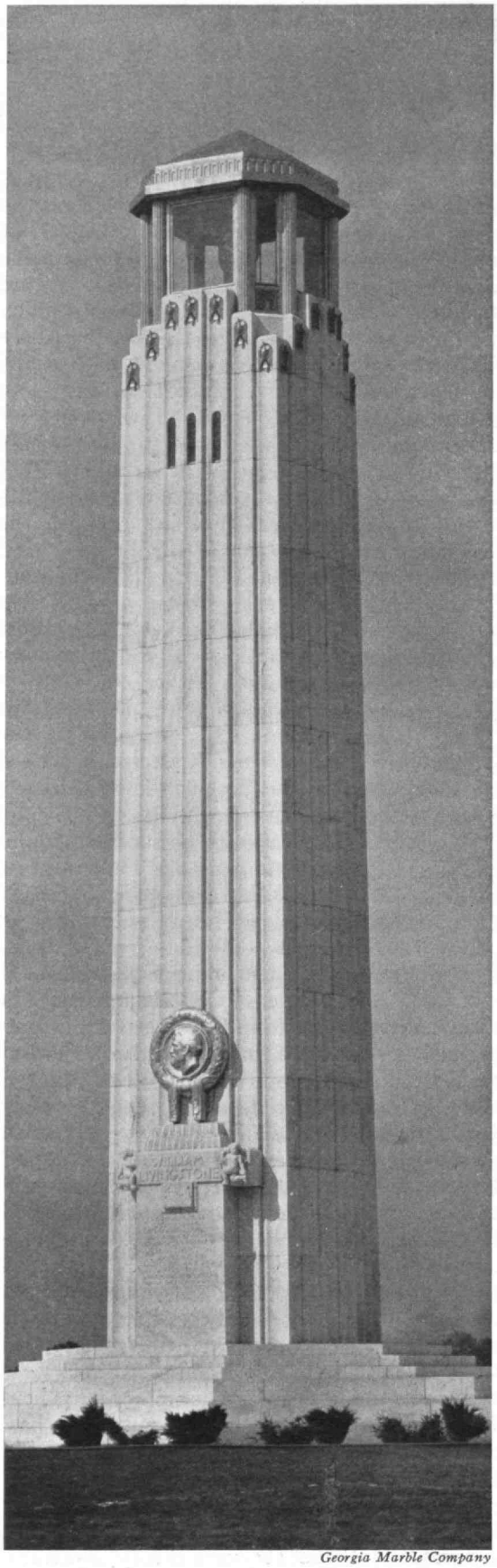
Leibnizian physics contains many startlingly modern ideas. For 200 years his views were eclipsed by the Newtonian system and it was not until the beginning of the present century that the technique of physical observation became sufficiently developed to suggest serious shortcomings in Newtonian mechanics.

Leibniz wrote at the termination of the pre-Newtonian period of groping and confusion, and it is now the post-Newtonian period of groping and confusion in which physics is enveloped. Thus, physicists are again prepared to find more suggestion in general philosophical considerations, such as those of Leibniz, than in Newton's great, finished discipline which the years have squeezed dry.

Leibniz stands unique in intellectual history. From the invention of computing machines to the collection of the remains of the dying Polabian language and from the discovery of the calculus to an attempted redintegration of Christendom, there is no aspect of scholarship which he did not touch and adorn. Despite the fact that there is but little to admire in his character — he had the flexible back of a courtier, and was more than once mean and disingenuous in his relations with other scholars — by the sheer force of his intellect and the bulk of his achievements, he stands out from the intellectual barrenness of the Germany that lies between the devastation of the Thirty Years' War and the revival of the mid-Eighteenth Century as an Alp amid molehills. Yet of all his vast contributions, almost none saw its fruition either in his own publications or in those of his disciples. The symbolism of the Infinitesimal Calculus is indeed his: the discovery itself he shares with Newton. His invention of determinants, his studies in mathematical logic and universal languages, his computing machines, his plans for the invasion of Egypt — all these were left for other and independent hands to complete and make real. The physical suggestions which form the object of this note were obscured by the more finished work of Newton, and have lain fallow for more than 200 years.

That all this work was sterile and unfinished is to be attributed to the fact that Leibniz was a very busy man. As archivist of the Hanoverian court and historiographer to the dynasty, he spent in the cataloguing and compilation of relatively insignificant genealogical information, the time that he might have devoted to his universal studies. And this universal genius — the last of whom it was truly to be said that he took all knowledge as his province — considered himself fully compensated by the opportunities he found to converse with royalty, and the royalty of Thackeray's four Georges at that!

As Leibniz was to some extent a disciple of Huyghens, the Leibnizian physics must be understood on the basis of the contributions of the latter. Huyghens, in turn, is best to be understood by comparing his work with that of Newton. The most famous point on which Huyghens and Newton differed is their theory of light. Huyghens was the father of the wave theory, and it is to him that we owe the famous "Principle of Huyghens" which asserts that each point on the front of a wave acts as a center of disturbance in the formation of a new



Georgia Marble Company

The William Livingstone Memorial lighthouse, near Detroit, Mich., erected by the citizens of Detroit and the Lake Carriers Association, of which organization Mr. Livingstone was President from 1902 to 1925

wave. Newton, on the other hand, held to a particle theory of light. Light for him consisted in a stream of particles of various velocities emitted from the source of illumination and he explained the phenomenon of refraction by "fits of easy and difficult transmission" on the part of the transmitting medium. During the Eighteenth Century, Newton's fame and the success of his mechanics completely eclipsed the work of Huyghens, but during the Nineteenth Century, the rôles were reversed and the study of the phenomenon of diffraction established a wave theory of light as the accepted view. At present, the situation is extremely confused. From certain standpoints, we know that a particle theory is demanded, while from others all the original arguments of the exponents of the wave theory remain valid.

FOR neither the wave theory nor the particle theory of light was a complete mathematical exposition possible at the time of Huyghens. The particle theory of light belongs, of course, with the particle dynamics of Newton, and demands the study of the ordinary differential equation. The differential and integral calculus which furnish the proper tool for this purpose were both established independently by Newton and by Leibniz. On the other hand, the proper tool for the treatment of any wave theory is the theory of the partial differential equation, and this is considerably more difficult. In the course of the Eighteenth Century this theory, too, was developed largely by the Bernoullis and later by Laplace and Lagrange so that when the wave theory came into vogue in the Nineteenth Century, the necessary machinery was in existence. What I wish to make clear, then, is that at the time of Leibniz neither the mechanics of the particle nor optics were in possession of their full mathematical machinery. It was by no means obvious which path physics was to take. The path chosen by Newton — the mechanics of a particle — involves as a necessary hypothesis action at a distance. The particle, which may be viewed by abstraction as a mathematical point is subject to forces, gravitational and otherwise, emanating from other particles remote in space, and traversing empty space, or vacuum, before arriving at the particle to be moved. On the other hand, the physics of wave motion presupposes a continuous medium through which all influences pass, and at least makes it plausible that these influences consume time in passing.

As I have said, this antinomy between particle and wave is incompletely resolved at the present time. Our electrons behave much as particles and somewhat as waves. Our photons, or light-quanta, behave much as waves and somewhat as particles. It is interesting to observe that the same opposition of these two seemingly irreconcilable views plays a most prominent part in the philosophy of Leibniz. Leibniz definitely abjured the vacuum and all action at a distance. On the other hand, he definitely believed in the existence of discrete monads, or soul-like entities, seemingly acting on one another. Again, the real activity of these monads was supposed by him to be one of perception. Each monad, he says, mirrors the whole world of other monads. Some mirror it more clearly and distinctly; others, more vaguely, confusedly, and obscurely. It does not require much imagination to see an analogy between this mirroring activity of the monad which appears to our confused vision like a causal activity, emanating from one monad and impinging on the other, and the modern view in which the chief activity of the electrons consists in radiating to one another.

This analogy may be carried out in a certain degree of detail. As I have said, some of the Leibnizian monads mirror the world more clearly, some less clearly. This lack of clearness in mirroring is responsible for our impression that there is chance and in-

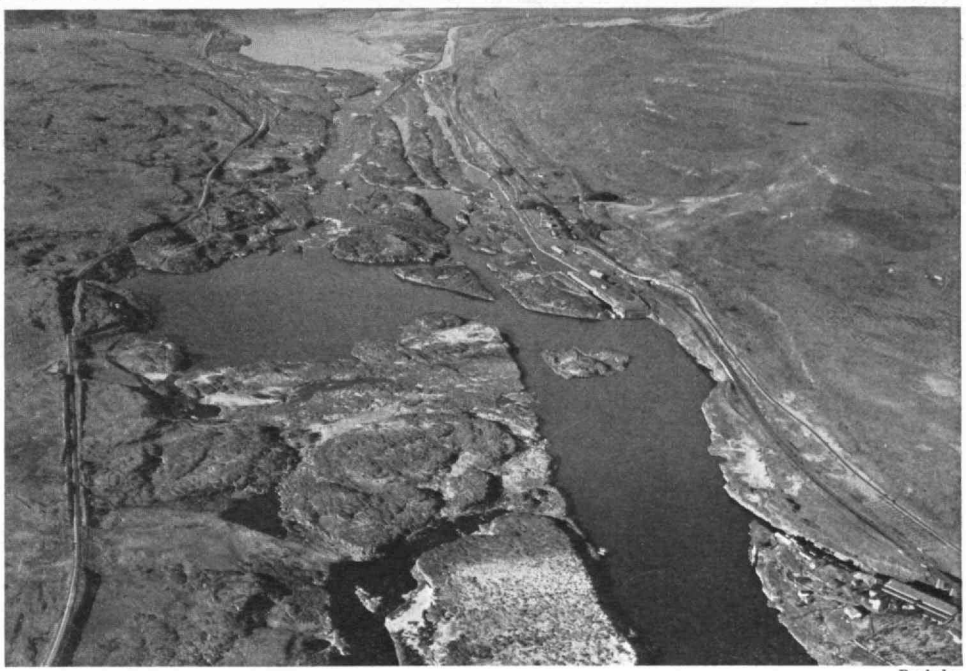
determination in the world. Now, in the modern quantum theory, the indetermination which is an essential feature of the world, as represented in the ordinary four dimensions of time and space, is resolved, according to Heisenberg, if a sufficient number of additional, unperceived dimensions are superadded. This is the meaning of the five-dimensional theories of Fock and Klein, and is even more clearly brought out by the study of the problem of many bodies. This problem, which at present possesses no complete solution either from the standpoint of quantum theory or from that of relativity, even in the simple case of two bodies, can only be treated on the supposition that each electron carries with it its own three dimensions of spatiality, or what is more likely, its own complete space-time world. Thus, each electron possesses its own world of dimensions, which mirrors the many-dimensional universe of perfect cause and effect in an imperfect, four-dimensional, non-causal image. It is surely not fanciful to see in this a parallel to the Leibnizian monads, which live out their existences in a self-contained existence in pre-established harmony with the other monads, yet mirror the entire universe.

IT IS not only the antinomy between the discrete and the continuous, between physics and optics, that represents an analogy between Leibniz and the present stage of mathematical physics. His philosophical principle of the identity of indiscernibles is a very live issue at the present moment.

Leibniz asserts that there cannot be two monads in the universe so completely alike that they cannot be discriminated from each other. The modern physicist states that physics has no right to introduce an entity which cannot be, at least theoretically, observed and measured. Thus, Einstein discards the notion of absolute rest or absolute motion, because he can find no conceivable physical experiment to discriminate between the two. Again, Heisenberg will not admit that a particle has simultaneously a well-defined position and a well-defined momentum, because any observation by which the one may be determined destroys the other. In other words, the slogan of modern physics is: back to experiment. Nothing that cannot be observed and discerned has a place in the world of the physicist. By this criterion, indiscernibles may not be recognized as distinct.

Let it be noted, however, that we should now recognize that two electrons which are individually indiscernible may yet by their relations to one another be discriminated as a pair. And here we meet Pauli's exclusion principle, which tells us that while two electrons may be discriminated to be a pair, it is, nevertheless, impossible to say which of the electrons is which. The relation of this to the principle of the identity of indiscernibles is arresting.

The principle of the identity of indiscernibles plays in Leibniz's philosophy the part of a corollary from the more general principle of sufficient reason. For Leibniz, all contingent truths, that is, all truths of particular fact, are determined not merely by the principle of contradiction, but by an additional principle which he calls the principle of sufficient reason, which asserts that some particular perfection must be realized by each phenomenon in this world and by this world as a whole to distinguish it from all other possible worlds. This principle is closely connected with Leibnizian optimism, which became so fashionable in the Eighteenth Century and which Voltaire so mercilessly assails in his "Candide." The reader will remember that Voltaire was not content with a purely impersonal attack on this principle, but supplemented it with a rather bitter personal quarrel with Maupertuis, his fellow scholar-courtier in Berlin. The impression which the wit of Voltaire has left on history is that Maupertuis was an impossible ass and was quite rightly laughed out of the country. This is not fully according to the fact. While Maupertuis was not completely free from the element of charlatanry, he made one very solid contribution (*Continued on page 222*)



Big Eddy on the Columbia River, potential water power site. Parallel to the rapids on the right may be seen the Celilo Canal

Brubaker

GRADUATE ENGINEERING INSTRUCTION

American Engineers Now Take Their Advanced Degrees at Home

By Joseph C. MacKinnon

PRIOR to the beginning of the World War (1914) there was little graduate instruction in engineering or science in the United States. M. I. T. had awarded only 73 masters' degrees and three doctors' degrees in engineering (excluding 50 masters' degrees awarded to graduates of Annapolis). A bachelor's degree was sufficient in engineering, while the students desiring the doctor's degree in science usually studied in Europe.

Since the War, the United States has occupied a more prominent position both in engineering and in science. Our students of science now obtain their advanced degrees at home, while in engineering it has become necessary in most fields to have graduate training in order to advance in the profession. The growth of graduate instruction has been phenomenal, especially in engineering, and Technology has taken a leading part (see chart on next page).

Although the total registration has practically returned to the post-war peak, the proportion of graduate students is distinctly much larger at the present time. This does not imply that Technology is becoming a graduate school, for the freshman class in 1930 was the largest in history, except for the year 1918 when students were admitted without examination to the Student Army Training Corps. Referring to the above chart, it is evident that the number of graduate students increased very rapidly until 1922, remained nearly stationary during the next few years, and then started another increase in 1928. In an article entitled "A Study of Engineering Enrollments" by Walter C. John[1], the total number of graduate students in engineering institutions in the United States in 1930–31 was 2,939. The graduate enrollment of the Institute was 539 or 22.4% (this includes students of science for the Institute and probably for the other institutions).

The important position of Technology in graduate instruction in engineering during the last decade is also shown by a comparison between the graduate degrees awarded by M. I. T. and those awarded by all other institutions in the United States. In Table I, the figures indicate that Technology has been awarding about 30% of the graduate degrees in engineering. These figures include both master's and doctor's degrees.

TABLE I

Percentage of Total Graduate Degrees in Engineering Awarded by M. I. T. 1922–28

(Data from U. S. Bur. Educ. Biennial Surveys)[2]

	1921–22	*1923–24*	*1925–26*	*1927–28*	*Total*
Total in U. S....	394	338	484	580	1,796
No. M. I. T.....	100	112	121	183	516
% M. I. T.....	25.4%	33.1%	25.0%	31.5%	28.7%

[1] The *Journal of Engineering Education*, Vol. XXII, No. 1, Sept. 1931, page 50.

[2] Latest edition "Biennial Survey of Education 1926–1928," U. S. Department of the Interior, Office of Education, Bulletin No. 16, 1930.

The Government Bulletins do not separate the master's and doctor's degrees. The data in Table II from the National Research Council[3] shows, however, that Technology has awarded about 30% of the doctors' degrees in engineering.

TABLE II

Number of Doctorates Awarded in Engineering

	Year										
	'21	*'22*	*'23*	*'24*	*'25*	*'26*	*'27*	*'28*	*'29*	*'30*	*Total*
Total	3	4	5	5	2†	11	10	28	34	49	151
Awarded by M. I. T...	0	2	1	3	4†	4	2	9	4	18	47

† Discrepancy. The S.P.E.E., in reference 4, quotes 8.

It can be assumed from these tables that M. I. T. has also awarded about one-third of the masters' degrees. Technology took the lead in the earlier days in establishing engineering instruction, and it is evident from the figures obtained that it is now taking the lead in graduate instruction and research in the United States. The question naturally arises, is M. I. T. outstanding, or is it only one of several leading institutions? Table III shows the graduate degrees awarded in 1927–28 for the 15 institutions which awarded ten or more degrees.

TABLE III

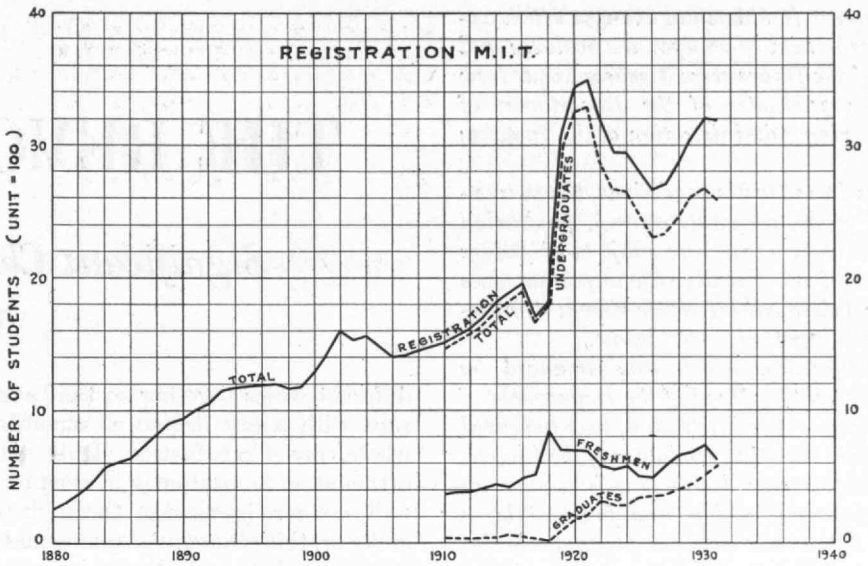
Institutions Awarding Ten or More Graduate Degrees in Engineering in 1927–28

(Source: "Biennial Survey of Education 1926–28," U. S. Dept. of the Interior, Office of Education, Bulletin No. 16, 1930.)

	Total Engineering Registration	*No. of Graduate Degrees*
M. I. T.....	1,965	183
N. Y. University.....	525	38
Harvard University.....	275	37
Purdue University.....	2,236	25
University of Mich.....	1,269	24
Cornell University.....	1,139	21
University of Pa.....	134	15
University of Mo.....	904	14
Col. of City of N. Y.....	218	14
University of Colo.....	681	13
Union College.....	243	11
Yale University.....	625	10
Case School of App. Sci.....	589	10
Penn. State College.....	1,355	10
Mich. State Col. of Agri. and App. Sci.....	572	10
Totals.....	12,730	435

The above tabulation indicates that Technology awarded four times as many as the second institution in rank and more than the next seven institutions com-

[3] "Doctorates Conferred in the Sciences by American Universities 1929–30." Reprint and Circular Series of the National Research Council, No. 95, 1930.



The comparative growth of undergraduate and graduate registration at M. I. T.

M. I. T. has been awarding about 30% of the graduate degrees in engineering

bined. It is desirable, however, to obtain an estimate of the prestige of M. I. T. in the various fields of engineering. This is somewhat difficult due to classification errors in educational statistics, for about one-third of the masters' degrees are awarded without classification as to field. Table IV presents an estimate as to which of the major departments at M. I. T. have contributed most to graduate work in engineering.

TABLE IV

COMPARISON OF GRADUATE WORK IN MAJOR FIELDS OF ENGINEERING AT M. I. T. WITH THE OTHER INSTITUTIONS IN THE UNITED STATES

Engineering Field	*Total Graduate Degrees 1927–28 excluding M. I. T.*	*Graduate Degrees M. I. T. (Average of 5 years (1926–30))*
Aeronautical	7	6.6
Chemical	34	28.6
Civil	75	6.6
Electrical	74	63.4
Mechanical	76	11.4
Mining and Metal.	30	3.2
Totals	296	119.8

It is assumed that the relative distribution of degrees in the major fields in 1927–28 for institutions other than M. I. T. is typical of the distribution for the two years preceding and the two years following. In the case of M. I. T., an average for the five years was taken to even out minor fluctuations. The 88 degrees awarded without specification and the 13 in minor fields are omitted from the United States figures and corresponding omissions are made from the M. I. T. data. This table indicates that M. I. T. has been awarding about one-half the degrees in aeronautical, chemical, and electrical engineering. The proportion pursuing work in most of the major fields would be larger if complete classification in other institutions were available. This is especially true in aeronautical and civil engineering and in mining and metallurgy. Chemical and electrical engineering are obviously the largest departments in graduate work, each awarding about as many degrees as all other institutions combined. Their prominence is not due solely to the coöperative courses in these departments, although they do attract a large number of students.

Graduate instruction in engineering should not be judged by mere numbers. In the Report of the Society for the Promotion of Engineering Education,[4] the following statement is made: "It is also probable that in many instances this fifth year of so-called graduate work is merely an extension of the undergraduate curriculum to cover certain special topics for which there is not sufficient time in the regular four-year course. Real advanced instruction in the fundamentals of engineering is given in only a very few institutions."

Technology from the beginning has stood for a high quality of advanced instruction. The number of graduate students in engineering in the United States has been increasing very rapidly, the increase being 164% in the last five years. It is not hoped or desired that the registration for M. I. T. should increase at this rate. Technology at the present time has only 3% of the undergraduate engineering students in the United States. This percentage is a material decrease from the early position when it was one of the pioneer institutions. Similarly, it is to be expected that, as graduate instruction increases in the United States, the percentage receiving their training at Technology will be much less than the present figure of about 20%. As the present graduate enrollment of about 600 is approaching the limit of our capacity, the scholastic requirements for admission to the graduate school were increased this past fall and the requirements for the master's degree will be increased next June.

[4] Report of the Investigation of Engineering Education 1923–29, page 323.

THE REVOLUTION

Significant Changes that Are and in Business

EDITORIAL NOTE. *Recent fundamental changes which appear to be having a permanent effect upon the business and industrial structure of the future were discussed at a New Year's conference for graduates of the Department of Business and Engineering Administration at the Institute on January 2.*

Significant changes in economic conditions, the marketing of manufactured goods, corporate control, production management, and account control were subjects of papers given by five members of the Faculty. So important does The Review consider this business clinic that a comprehensive summary of the reports is given below.

Interest in the conference, which was arranged by Professor Erwin H. Schell '12, Head of the Department of Business and Engineering Administration, was indicated by the attendance of more than 200 graduates of the Course, many of whom indicated their desire that it become an annual event. The morning session was followed by a luncheon at Walker Memorial, with the program continuing in the afternoon. Following the presentation of each paper there was general discussion of specific problems.

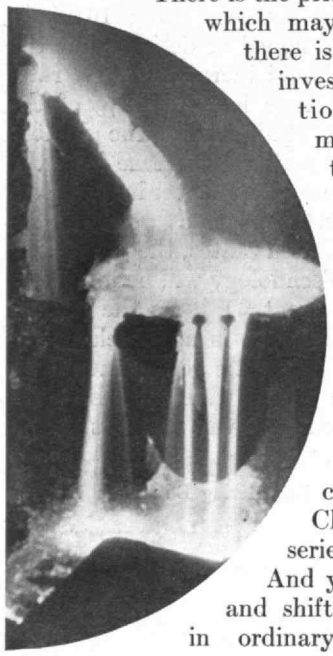
ECONOMIC CONDITIONS

BY DAVIS R. DEWEY

Head of the Department of Economics and Statistics

FROM the host of economic problems which beset us on every side, it is possible to select only a few for special consideration. Of first importance is an understanding of the economic disease from which we are suffering.

First, then, the diagnosis. The central point of economic analysis is price. We live in a competitive economy which expresses itself in some kind of price. There is a price for every commodity — a wholesale price and a retail price; there are prices of raw materials and of finished products. Again, there is the price of labor which we call wages, and this may be priced on the farm, in the factory, the mine, or the office. It may be the price of unskilled labor, or the price of skilled labor. There is the price of governmental services which may be designated as taxes; there is the price of fixed capital invested in business organizations, including railroads, mines, and factories; and the prices of many of these are expressed on the stock exchanges of the country. Again, there is the price of credit, and this also assumes many forms: short-time and long-time credit, domestic credit, and foreign credit.



These prices are in a continual state of flux. Changes in the price of one series offset that of others. And yet, in spite of these rapid and shifting changes, we are able, in ordinary times, to gear these different series together so that our economic machine runs with a fair degree of smoothness, which, on the whole, gives satisfaction. It is not at best a perfect machine; it is constantly in need of repair. But we may well wonder, in view of the multitude of parts which make up this economic machine and the delicate adjustments which have to be made in fitting them together, that the machine works at all.

Now, if for any reason there is a sudden shock, the several parts are thrown out of balance with each other, so that there is maladjustment; the machine breaks down. If prices of commodities, wages, price of credit, taxes, and so forth, previously geared together at certain levels, suddenly shift, some going up, some remaining stationary, and some going down, then exchange from the level of one price series to the level of another price series is interrupted. We have maladjustment; our economic system is out of balance.

New levels must be established and the several parts again adjusted. Certain fields of our economic relationships lack flexibility. In some the adjustments can be quickly made, in others the price adjustments are retarded. Wages do not change as rapidly as prices. The price of long-term credit contracts, previously entered into, is fixed and cannot be changed except by mutual consent or through breaking the contract by bankruptcy. And the price of public services, represented by taxes, is not flexible or easily adjustable.

There is not sufficient space to show in detail how the machine has been thrown out of balance. Prices of commodities in general have fallen 30% in less than three years. The fall in prices of finished goods, however, is not one-half that of the average price decline. Fixed charges have remained almost stationary.

The fall of prices has increased the burden of reparations imposed upon Germany by one-third. Due to this decline in prices England owes the United States as measured in commodities, after paying us hundreds of millions, more than she did when payments began.

Of great significance in this maladjustment is the position of credit. During the past quarter century, the supply of credit has been multiplied many fold. It was enormously increased during the war. Short-time credit oils the gearing of the economic machine so that it runs more smoothly. But in addition there has been a most extraordinary increase in long-time credits. These are contractual obligations which can be met only if the machine continues to run smoothly. If there be a decided fall in commodity prices it may be impossible to meet these obligations.

ON THE RIALTO

Observable in Economic Conditions Technique

In this diagnosis of our economic disturbance it is folly to disregard the parts of the economic machine which are located in foreign countries. These parts are geared into the machine which we are working here at home. Our foreign economic policy may have been a mistake, but we must recognize conditions as we find them. These relationships have been developed through trade, international credits, and commodity prices. Even if our foreign trade is sacrificed through tariff barriers in the interest of home products, we have to reckon with the immense volumes of foreign credits which migrate from one country to another. This migration of capital in turn affects the solvency of banks and the maintenance of gold standards. It is impossible for the United States to free itself — at least in the immediate future — from the repercussions of these changes.

Moreover, the price of many of our domestic commodities is fixed in a world market, and we cannot disregard the forces which are operating in foreign countries, which in turn affect the welfare of our producers.

The third point to be noted relates to the proposals for planning so as to avoid future depression. Planning appears to be an attribute of wisdom and prudence, and is to be commended. But the proposed plans need to be carefully scrutinized. Shall they be carried out by voluntary concerted action or by legal restrictions laid down by the government? If voluntary, can they under our competitive system of individual enterprise be successfully maintained? If governmental, to what degree will there be an encroachment upon personal initiative and individual liberty?

PRODUCTION MANAGEMENT

By Erwin H. Schell

Head of the Department of Business and Engineering Administration

A SIGNIFICANT change in production management is taking place. Its influence is apparent in every aspect of manufacturing operations. It has resulted from the increasing dominance of the market, the continued decline in prices, and the excess of manufacturing facilities. Manufactured goods pass through a series of processes which in the past have been sharply segregated. Purchasing, stores, inspection, fabrication, and assembly — each have represented separate industrial domains. Through these divisions parallel lines of product have proceeded. In other words, the stream of goods in manufacture is divided crosswise by processes and lengthwise by products.

The striking change in production management is the strong swing away from the control of process to the control of product. Today the manager knows the exact status of any one of a variety of lines of output, while yesterday he was better informed of the relative efficiency of each department in his plant.

The stores department used to be termed the "factory bank" and materials were viewed much the same as currency. Now, in some plants we find only a vestige of the original department, while a so-called "program control" routes materials through production sequences in terms of the precise demands of the market.

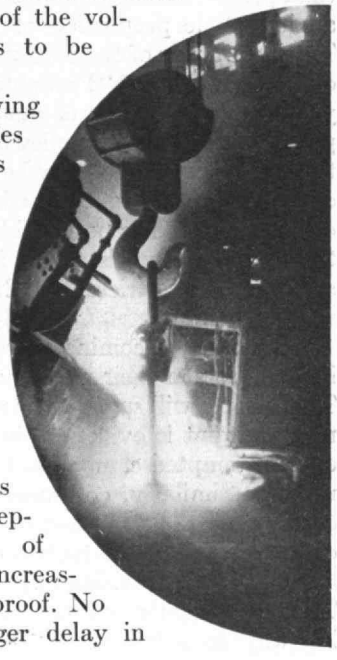
In purchasing, we find arrangements being effected with vendors so that materials arrive in a thin, swiftly flowing stream, the volume of which fluctuates precisely with the needs of the ultimate consumer.

Even the inspectors who used to be a law unto themselves now find their activities integrated in terms of the product. New forms of incentive payments are linking their interests with those of the productive operators in the attainment of a common goal of quantity and quality and segregated inspection departments are giving way to product scrutiny as it passes along the fabricating line.

In our factory wage systems, the trend toward group bonus has for its purpose the development of product- rather than process-consciousness among employees. Indeed, it is not uncommon to find such bonuses calculated upon the number of finished products rather than upon production at each stage of manufacture.

The fabricating departments were almost the first to show the influence of this new point of view. Straight-line or serialized machine layout was first thought applicable only to concerns enjoying large and uniform product demand. Other plants soon found that surplus equipment might well be used intermittently in such production lines with a desirable economy in set-up as well as direct labor costs.

Above all of these productive functions, we find the new mantle of budgetary control which again lays major emphasis upon product. Indeed, its basis lies in the determination of the volumes of specific products to be manufactured.



Finally, we note the growing tendency in large companies to departmentalize in terms of products and this trend bids fair to continue to the point where each of such divisions will include its own financing and distributing functions.

While numerous obstacles prevent the full development of this trend in many businesses, there is no question that any exceptions to this new rule of industrial conduct must increasingly bear the burden of proof. No manufacturer should longer delay in

applying to his productive organization these test questions: Am I managing my product or my processes? Am I relating my production to consumer demands, or to processing standards? Are my suppliers catering to my orders or my inventories? Are my stores serving as shock-absorbers or as reservoirs? Are my inspectors interested in output of a given quality, or in quality irrespective of output? Are my products in process being routed in terms of operations or in terms of departments? Are my wage systems stressing production or processing? Am I developing productive facilities around my products, or am I adjusting products to my facilities?

DISTRIBUTION

By R. F. Elder

Assistant Professor of Marketing

THE decline in the general price level has led to a shrinkage in dollar volume of sales, even though the physical volume of goods sold remains approximately the same. Since it takes as much space, as much of the sales-person's time, and as much supervision to sell a unit of merchandise as it took before, a higher proportion of the dollar spent in the retail store must go for selling costs until such time as labor, capital, and rental costs can be reduced. Those sellers who have been able to effect economies in their distribution methods are gaining business at the expense of their competitors.

The preliminary statistics of income for 1930 show that individual gross incomes amounted to $21,665,000,000 compared to $28,762,000,000 in 1929. Figures for 1931 will undoubtedly show a still greater fall in this indicator of purchasing power. With consumers determined to maintain their standards of living, the result is that less money is being spent on each commodity rather than that certain goods are being dispensed with. This means a demand for cheaper goods. Because of the large fixed elements of selling cost, merchants and manufacturers are to a very general extent "trading down." The quality of goods is declining more rapidly than prices. The inventory of the average store contains an incredible proportion of junk. The Better Fabrics Testing Bureau of the National Retail Dry Goods Association has stated: "Probably at no time in the last 15 years have standards of quality been so low as in the past two years." This policy of reducing quality in order to sell cheaper is probably being carried to extremes. In catering to people of reduced purchasing power, insufficient attention has been paid to those who have money to buy quality goods. There is ample evidence that this situation has restricted purchasing on the part of those well able to buy.

Buyers are becoming more discriminating. Reduced incomes stiffen their resistance to high-pressure selling. That people will spend their money only for things they need or want is evidenced in the failure of the persistently attempted campaigns to "buy now" for patriotic reasons. Similarly, consumers are losing their faith in certain forms of advertising. It is interesting to note that cigarette sales are falling off despite the reported $47,000,000 advertising appropriations of the Big Four. The old customer loyalties to a store or a brand are giving way to a tendency to compare values. This is a direct result of reduced purchasing power. Consumers may not be any more articulate as to what they *do* want, but they are more keenly conscious of what they *don't* want.

The most significant change in distribution is the greater emphasis which business leaders are putting on the merchandising function, which is essentially finding out what the customer wants and giving it to him. There is an increasing realization that sales strategy alone will not sell goods, and that the product is the vital factor. C. F. Kettering, of General Motors, has advanced the most sensible remedy for the depression yet offered: "In order to sell we must create products that people want more than they want money in the bank." New products, or old products radically improved, are keeping some industries busy and prosperous. Failure to revamp the old product to bring it in line with changing demand is soon reflected in sales figures. Considering automobile registration for the first eight months of 1931, we find that while the entire industry was off 27% from 1930, producers other than Ford lost only 7%, while Ford sales were off 49.5%.

Within the last few months there has become apparent among marketing men a very encouraging attitude. They are realizing that a period of depression is a period of readjustment, of selling methods, of merchandise, and of policies, so that money can be made with things as they are; not as they were last year, or as it is hoped they will be next year. They are beginning to reëxamine the suitability of their products from their customers' viewpoint. They are scrutinizing their marketing expenses and pruning out the extravagances left over from the days of big volume. Incidentally, they are spending more money on accounting for their sales costs, and for maintaining records which give them adequate sales control. And, finally, they are adopting budgetary control of sales and production, based on attainable sales goals, and not on the old policy of "beat yesterday."

ACCOUNTING CONTROL

By Wyman P. Fiske

Assistant Professor of Accounting

FOUR significant trends in accounting control are apparent, each a reflection of a trend in management interest. (1) New devices and methods for bettering control of expenses are being developed. (2) The effects of general economic forces are being segregated. (3) Accounting records are finding increased use as measures of operating results. (4) Accounting analysis is being extended to fields outside factory costs, notably to marketing costs and administrative policy.

There has been a definite shift of emphasis from cost determination to cost reduction. The accountant is recognizing the importance of the Law of Exceptions, which is that "managerial efficiency is greatly increased by concentrating managerial attention solely upon those executive matters which are variations from standards." Variations from scientifically determined standards are being accumulated in the accounting records and included in reports to management. The budget has appeared as a coördinating device and control tool. The budget is a method of combining (*Continued on page 228*)

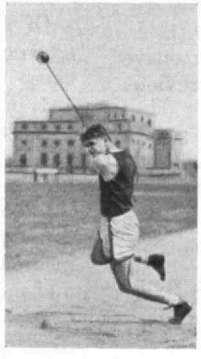
ATHLETICS AND HEALTH

Do College Sports Injure the Heart?

By Allan W. Rowe

EVEN in sport-loving and sport-practicing America there exists a significant group which opposes all forms of sport on the basis of harmful physical effect. Unhampered by fact and in part, at least, actuated by a well-meaning but ill-advised and ill-directed fanaticism, it leads, from time to time, an attack upon some one sport or a group of sports which for the moment excites its disapproval. Older followers of sport will remember the crusade waged against college football many years ago and Walter Camp's careful study as to the actual underlying facts of the cases cited by the proponents of football abolition. The boy who was reported as killed because of football and who actually was the victim of a street-car accident when returning from a football game in which he had participated was but one of a number of misleading illustrations, put forward, let us hope, in good faith.

Not considering, however, these fanatic outbursts which are engendered solely by prejudice and not by reason, there yet remain questions which must be answered by all of those who are responsible for the welfare of any group in the community. One of the obvious duties which any educational institution must exercise in the care and control of its students is the maintenance of health and physical well-being in the undergraduate group. The responsibility which rests upon the shoulders of the head of the health department of any university is a heavy one, and questions are presented to him daily calling for decision which might affect the health of a considerable portion of his charges. At M. I. T. one such question arose last year as to the possibility of the exercise of rowing producing unfortunate and injurious effects upon the action of the heart. A number of the men in the several crews, all of whom had been carefully examined medically before they were allowed to participate in the sport, developed conditions suggesting lowered or impaired functional activity of the heart. Naturally, they were promptly withdrawn from competitive exercise and as promptly safeguarded from any further injury, if indeed injury had been done, which is very doubtful.



The question, however, is a much larger one than that of the few men who were dropped from the crew and resolves itself into a survey of rowing as a sport and its possible deleterious effects upon an appreciable number of those pursuing it as a recreation. Being personally deeply concerned with the conduct of competitive amateur sport as practiced in our colleges, and directly responsible for certain aspects of it as relating to the student body of the Institute, the writer has considered this question at some length and in some detail. In order to clarify the present situation and establish a sound basis for future conference and consideration, a brief survey has been made of existing literature bearing directly on this topic. This survey embraces a review of over 20 titles, in the main written by men who are recognized as authorities in the field on which they write. Dealing specifically with the sport of rowing, in a few instances, the majority of the papers treat the subject from a broader basis and consider the general influence of various forms of competitive activity upon physical health and well-being. The heart, naturally, is the organ primarily considered, and the papers as selected deal with the question of physical exercise and the heart.

From the material assembled in this article, it would seem to the dispassionate observer that, in the health control of college athletics, it is only necessary to insure the prospective contestant from existing cardiac pathology. The medical examination by a competent practitioner, specially trained in this field and utilizing such additional laboratory procedures as modern science has contributed to modern medicine, should prove a wholly effective insurance against an unwise indulgence. To deny any healthy lad participation in competitive sport, that most normal and wholesome of recreations, would seem to be unwarranted. By safeguarding the unfit, the field is left open to the boy who can derive only health and pleasure from the exercise of his physical powers.

WITHOUT further preamble, a brief review of the several papers noted, may be considered. In 1914, Schumacher and Middleton[1] made an extensive study on the cardiac effects of "immoderate" college athletics. The groups selected were:

a. 20 controls no active sports or training.
b. 3 athletes with "normal" hearts.
c. 10 " , cardiac hypertrophy and slow action.
d. 12 " , cardiac hypertrophy and irritability.
e. 12 " , cardiac hypertrophy, murmur before and after test.
f. 2 " , acute cardiac dilatation.
g. 7 " , older men formerly in competitive sports.

Their conclusions may be summarized thus:

(1) Athletic training leads at first to physiologic hypertrophy of the heart; but when prolonged and marked by severer athletic contests it usually leads to hypertrophy plus dilatation of a variable degree, frequently marked by valvular insufficiency.
(2) Functionally, the hypertrophied heart, even when dilated and giving distinct evidence of valvular insufficiency, may prove more fitted to carry the man through a severe athletic contest than a normal heart would be. On the other hand, acute cardiac dilatation occurs more frequently in athletes and men used to severe muscular strain than in normal men, and the ultimate effects are more prolonged and severe.
(3) There is reason to believe that for normal human activities, an "athletic" heart is distinctly disadvantageous.

During the next year, 1916, a study was published by Lee, Dodd and Young[2] in which groups of oarsmen were the subjects. Avoiding the carefully selected pathological groups of Schumacher and Middleton, in which the ascription of cardiac disease to exercise was in certain measure presumptive, they took three consecutive series chosen solely for their common participation in a single sport. The groups were:

(a) 16 freshmen of athletic type all of whom had been active in physical exercise and a few of whom had rowed previous to entering college.
(b) 16 candidates for crew, all of whom had rowed from two to four years.
(c) 10 graduates, older men with an average record of 10 years rowing experience. All had rowed in at least one four-mile race in college and had been active since graduation.

Careful physical and radiologic measurements demonstrated:

1. No irregularities of heart action.
2. No abnormal blood pressures.
3. No albumin or sugar in the urine.
4. No cardiac enlargement.

In group "A," one subject had a functional murmur; in group "B," there was one systolic murmur, probably functional; and in group "C," two slight functional murmurs were recognized.

They conclude:

The only conclusion that can be drawn at this time from this particular study is that prolonged participation in rowing under the system now in vogue at Havard University and the Union Boat Club of Boston, does not materially increase the size of the heart when the heart is normal at the beginning.

Meylan,[3] quoted by Cole,[4] is the authority for the statement that between the years 1852 to 1892 there was no case of cardiac disease among Harvard oarsmen. That this pleasing state of affairs is not confined to one educational institution is attested by the article of Greenway and Hiscock,[5] quoted editorially in the *Journal* of the American Medical Association[6] in which analysis demonstrated (a) that college graduates live longer than a like group of non-college men and (b) that there was no evidence of injury to the health of Yale athletes as the result of competitive sports.

The first of the conclusions is confirmed by Dublin[7] in an article on the longevity of college athletes. His figures, however, do not implicitly support the second conclusion in its broadest aspect. Designating the expectancy of death as drawn from actuarial tables as the unit, (*i. e.* 100%), he finds the actual percentages, shown on the following page, to derive from a study of 4,976 graduates of ten selected universities all of whom had graduated 33 or more years previously.

Before the age of 45, with the sole exception of crew and baseball, all of the groups show an improved expectancy over the non athletic individual. Inspection of the table demonstrates certain disconcerting inconsistencies such as the fact that participation in two or more sports shows next to the best record before 45 and triumphantly leads the field by a large margin after this chronological Rubicon is passed. Dublin, however, draws the following conclusion:

Of the 315 who died at ages over 45 and whose cause of death we know, 101, or 32%, were ascribed to diseases of the heart. This preponderance of deaths from heart disease is, of course, significant. Among carefully selected insured lives rarely do we find more than 20% of the deaths at the ages over 45 resulting from heart disease.

In other words, the athletes, in spite of their better longevity record than insured men, showed a worse condition as to heart disease. The full importance of this finding is still obscure.

The other important causes of death at the older ages are diseases of the nervous system, Bright's disease, pneumonia, and accidents. The incidence of each of these causes is fairly normal except for accidents, which show a higher mortality ratio.

Taken by and large, it would appear that the group of college athletes studied presented a favorable mortality picture. The experience has been much better among recent graduates than the earlier ones, with the single exception of those who were on the crews."

Sport	*Under 45*	*45 and over*
Football	88.7%	87.9%
Two or more sports	89.7%	71.9%
Track	97.8%	82.9%
Rowing	107.9%	89.2%
Baseball	108.1%	93.9%
All sports combined	96.0%	88.5%

In fairness from the figures cited it would seem as if baseball should be placed in the same category with rowing as it has the worst individual record of all the sports listed. Further, one cannot but wonder how many of the "two or more sport" group rowed or played baseball as one of their activities. The period from which the subjects were selected automatically eliminates many sports that today play an important part in the athletic program and the choice of the two-sport men would be definitely circumscribed.

Dwight,[21] a director of one of the insurance companies, found that cardiovascular disease was much more prevalent among their policy holders in those who followed a sedentary occupation in the city than it was in those whose occupation involved physical exercise in the open air, as farmers. The factor of tension or nervous strain was important in apparently increasing the frequency to cardiovascular disease.

THE question of cardiac hypertrophy has been one of those most thoroughly canvassed. Gordon, Levine, and Wilmaers,[8] studying cardiac size by the x-ray in a group of marathon runners, found no evidence of enlargement and concluded that "many years of the most vigorous physical effort did not produce cardiac hypertrophy." They added the interesting observation that immediately following a race there was a temporary decrease in heart size, with a return to normal during the next 24 hours. This second observation has been recently confirmed by Richards,[9] Buytendijk,[10] and Farrell, Langan, and Gordon.[22]

These last-named authors found, by careful x-ray studies, that in 13 runners, the hearts appeared to be definitely smaller than normal; in five runners the hearts were within normal limits; and in five instances the hearts, according to predicted normal diameters, showed an increase in size. According to the so-called cardiothoracic ratio, only one heart was increased in size. The data as a whole suggest that the immediate effects of long distance running are inconsequential, since all the changes noted may be found in persons of similar age who are without symptoms.

In a series of papers, Herxheimer and his associates [11, 12, 13, 14, 15] report a variety of studies. Examination of groups of boxers, swimmers, runners at all distances, ski runners, and so on [11] leads to the conclusion that the groups indulging in the prolonged exercises have slightly larger hearts than the other athletes or than non-athletic individuals with whom the latter conform. In a later paper [15] he establishes the "heart quotient" as the heart volume divided by the body weight. On this basis, he lists competitors in various sports sequentially in the order of apparent enlargement as follows:

Non-athletic, sprinters, and long-distance swimmers show average figures of 1/62.3 to 1/63.8.

Other records are

Short-Distance Cyclists / Middle- " Runners	1/55.1
Boxers	1/52.7
Oarsmen	1/51.7
Long-Distance Cyclists	1/48.7
Marathon Runners	1/46.4

The last group, *i.e.*, the Marathon runners, have the largest hearts. The report on boxers is inconsistent with his earlier observations [11] at which time they showed the smallest hearts. In other papers [12, 14] he concludes that in sports which do not require prolonged effort, the body musculature and the heart increase synchronously and proportionately thus maintaining a normal ratio. Where prolonged exertion is necessary (skiing, cycling, rowing, and distance running) the cardiac enlargement outstrips that of the skeletal muscles. There is, however, no dilatation. He believes that this hypertrophy is harmless, being possibly influenced in part by his study of a group of 50 outstanding athletes of older years, all of whom he examined clinically. He and his associates found no evidence in this group of any injury from their earlier exercise and especially none of them showed any arteriosclerosis. They did recognize an apparent slight increase in the width of the aorta, the interpretation of which they regard as unknown.

Dedichen [16] has studied three hundred and sixty-one competitors in a 50-kilometer ski race and found cardiac hypertrophy in 50 (13.8%) as against a similar condition in 12% of a group of 210 dock laborers. He adduces some evidence that the hypertrophy is transitory and that the heart ultimately returns to normal size when competition is discontinued. He finds no evidence that ski running produces immediate or subsequent injury to the heart.

Barringer,[17] in discussing the etiology of heart failure, states:

> The unimportant part which physical or mental strain plays in causing heart failure is shown by the few instances we report, 7 out of 154 patients. It seems improbable that the condition produced by these unusual causes is any different from that existing generally in cardiac failure, for 6 of these patients showed fever and 3 a leucocytosis.

Cole [18] maintains that exercise cannot injure the normal heart but may affect one already diseased. He regards the nervous system (*Continued on page 224*)

THE TREND OF AFFAIRS

IN THIS SECTION: Is the Humidification of Residences Practical and Wise? (212); Self-Unloading Boats and Other Specially Equipped Vessels (214); Glass Insulation (217); Reviews of "A History of Aircraft" and of "Communication," or Engineers Who Can Write (216); Colloid Chemistry (212)

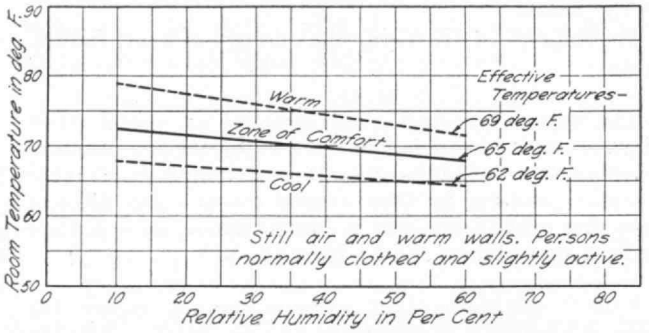
The Glue Family

THE name of colloid this year attains to its three score years and ten, for it was in 1862 that Thomas Graham defined and distinguished colloids and crystalloids. This is young for a name which distinguishes a special branch of science. Dispersoid chemistry is a well-recognized field. The American Chemical Society has a Colloid Division. The Germans have a *Kolloid Zeitschrift.* And the name means only gelatinoid, or glue-like.

While the name is young, the colloids themselves are an ancient race, the most ancient of all races, as old as life — for all living matter is colloidal. Before ever life was, there were colloids, and the colloids conspired with one another and there was protoplasm.

Graham observed that salt and many other crystalline substances, if dissolved in water, diffused through a parchment membrane, while glue, under like conditions, diffused but little or not at all — and gave the name of colloid, from the Greek word for glue, to substances which possess this latter character. Solutions of colloidal substances may be filtered through the usual filtering mediums without change. They appear clear in ordinary light, but are opalescent under intense illumination. They consist of exceedingly small particles of the colloidal material, particles, however, which are vastly larger than molecules but are yet so small that they do not settle out of the solution. The natural motion of the molecules of the solvent keeps the larger colloidal particles in suspension and in constant movement. The movement may be seen if a narrow and powerful beam of light is passed into a drop of the solution under a microscope. The Brownian movement may be seen in the ultramicroscope — for the particles, too small really to be seen, are yet large enough to reflect some light, and twinkle in the powerful illumination like little stars.

Colloidal solutions of the metals may be prepared in a variety of colors, either by treating a solution of some salt of the metal with a reducing agent, or by passing an electric arc between pieces of the metal under water or another solvent. If the colloidal particles are small, the solution appears blue by reflected light, for the small particles are large enough to reflect the blue light of short wave lengths but not large enough to reflect the longer wave lengths of the red end of the spectrum. They allow these to pass, and the solution by transmitted light appears reddish brown. A colloidal solution which exhibits these properties may be secured by adding a little milk to a glass of water. In that case the colloidal particles are ultramicroscopic globules of butter fat.



Comfort chart developed by the Research Laboratory of the American Society of Heating and Ventilating Engineers. *See page 214*

Solutions of colloidal silver, argyrol, collargol, and so on, find wide use in medicine as antiseptics for infected mucous surfaces. Their action is not well understood. When it is, there will be an important scientific discovery, for they kill the germs in or on the body but are without effect on the same germs growing in cultures in glass vessels.

The ancient Babylonians knew how to manufacture glass which was colored red with colloidal gold, but the art was lost and the other nations of antiquity produced red glass, or glaze, by a different principle by the use of compounds of copper or of iron. In the Seventeenth Century a German, Dr. Cassius, prepared a purple pigment by adding stannous chloride to a solution of gold chloride. His purple was hydrated stannic oxide colored with colloidal gold. Johann Kunckel von Löwenstern soon found a way to prepare ruby glass from the purple of Cassius. Several pieces which he made for the king of Saxony are still preserved in the Museum at Dresden. The red glass which is now so extensively used for railway and traffic signals and for photographic purposes is colored with colloidal selenium.

Humidification for Residences

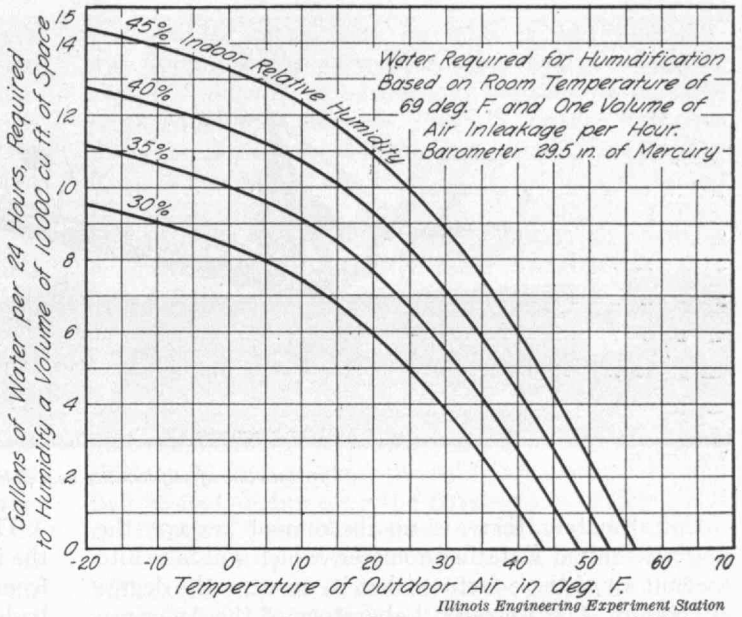
WE HEAR on every side that we are entering an age of air-conditioning, an era of manufactured weather. The air-conditioning engineer has even been heralded by professional optimists as the Moses who will lead us out of the depression by the simple achievement of making the control of indoor weather so practicable, cheap, and appealing that the moribund buying public will be revived and will demand that the trains and ships it patronizes, the place it works in, and its home be air-conditioned.

If there be an excess of optimism in this roseate view, the fact remains that there are many signs and portents to support the forecast. For a number of years, groups of engineers have been converging on the problem of making air-conditioning commercially practical for small interiors. Some one with a penchant for statistics

has counted 70 companies engaged in research for providing improved air-conditioning equipment, particularly for offices and residences.

Some of these companies champion complete systems that will cool and dehumidify indoor air in the summer and heat and humidify it in the winter. Others are manufacturing single room units, either for summer cooling or winter humidification. Since winter comfort is a very present problem, we shall confine this discussion to winter conditioning in the anticipation of examining at a more seasonable time the art of keeping cool.

Heated air has a great capacity for absorbing moisture. In other words, the capacity of air for holding moisture increases with its temperature. For example, the air required to fill a space of approximately 15,000 cubic feet at zero degrees Fahrenheit can hold but one pint of water, whereas at 70°, it can hold two gallons, or 16 times as much. This means that, when air is heated, it tends to absorb moisture, and this accounts for its drying effect.



Curve showing the amount of water which must be evaporated to yield given relative humidities under various conditions

It is the purpose of winter conditioning, or humidification, to supply the heated air in our buildings with the proper moisture, which, it has been generally agreed, is in the vicinity of 40% relative humidity.

When the weather is cold, this is obviously difficult to do, so thirsty is the air, not to mention the walls and furnishings, and so great is the air leakage of buildings, particularly residences. When the temperature is in the vicinity of zero degrees Fahrenheit on the outside, the maintenance of a 40% relative humidity under certain conditions requires the evaporation of one gallon of water per hour. This means, of course, that water pans on tops of radiators would not be adequate, nor would the water pans in hot air furnaces.

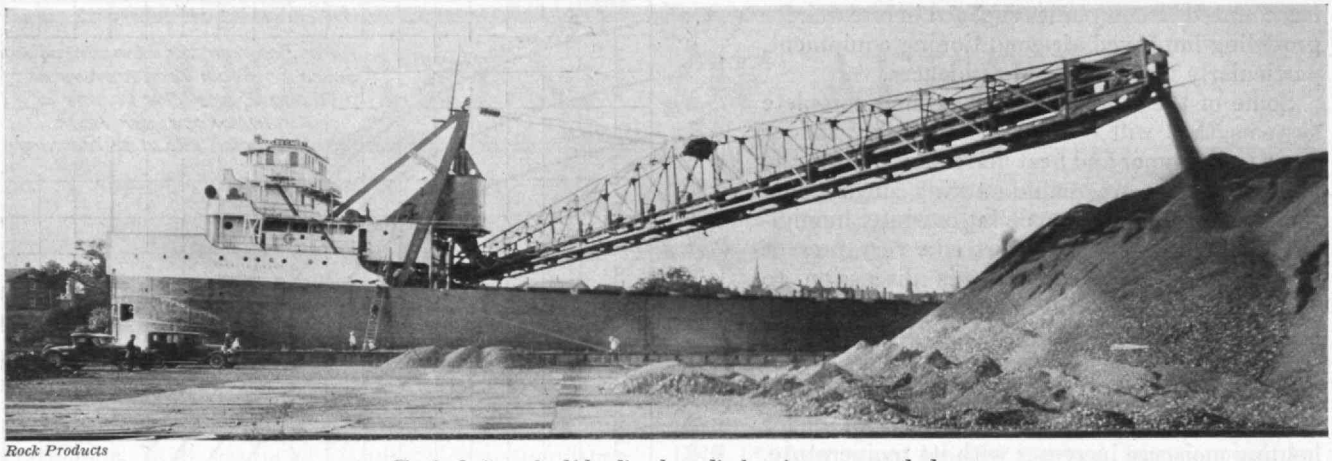
The curves shown at the top of this page give an approximate reading of the amount of water it is necessary to evaporate at various outside temperatures in order to obtain humidities of from 30% to 45%. Those who are contemplating installing humidifying devices in their homes will realize from these curves that the equipment must evaporate surprisingly large quantities of water in cold weather.

There are, of course, a number of humidifiers of adequate capacity to evaporate ample water. Some are simply small editions of the spray "heads" which are used in industrial plants. By means of pressure or electric fans, these project water to the air in the form of a very fine spray. They are usually noisy, particularly those with fans; and because they spray instead of evaporate, there is danger of wetting adjacent objects. One company has recently designed for residences an evaporation radiator, which evaporates water by heating it with the steam from the heating system. Since this humidifier has no moving parts, is perfectly quiet, and is also subject to automatic regulation, it possesses many advantages over the fan or spray devices. To be sure, it requires permanent connections with the heating and water supply systems. Still another company is actively advertising equipment to be appended to hot air furnaces, the price of which is of the order of $200.

The criteria for all of these systems are: their evaporative capacity, their economy, their quietness, and their sensitivity to regulation; that is, these are the criteria if one accepts the hypothesis that it is wise and feasible to humidify a residence. Many investigators contend that it is not necessary and expedient to do this; one group claiming that houses are not adequately constructed to make humidification practical and that if they were, air-conditioning would be almost unnecessary; another contending that the humidity may be sufficiently controlled, so far as health is concerned, by varying the dry-bulk temperature; and still another maintaining that humidification is economically impractical, the mechanization of the home having already been carried to the extreme. There is ponderable evidence behind these left-wing views that should be carefully considered by prospective purchasers of humidification equipment. No one questions, however, the value of humidification to prevent deterioration of furniture, wallpaper, hangings, and rugs as a result of excessively dry air.

Before accepting the ballyhoo of the advertising pages, the home owner might also wisely familiarize himself with the theory behind air-conditioning. He will find that it is predicated on two separate needs, comfort and health, and that these two do not always coincide. Optimum comfort at any season depends not so much upon ordinary dry-bulb temperature, but upon the degree of ease with which the human body can accomplish its heat regulation. This regulation depends not only upon temperature, but on humidity and air motion as well. In other words, the elimination of heat from the body surface depends upon convection, radiation, and evaporation. One investigator (Aldrich) has concluded that at normal, indoor temperature, in still air, the clothed body at rest dissipates heat approximately as follows:

Convection	30%
Radiation	46%
Evaporation	24%



Rock Products

Typical view of self-loading boat discharging cargo at dock

Unfortunately there is no instrument (except the severely limited Katathermometer) which will take into account all of these factors; that is, measure the degree of comfort. The Research Laboratory of the American Society of Heating and Ventilating Engineers, however, has determined empirically a condition of maximum comfort which it expresses in terms of *effective temperature*. Combinations of dry-bulb temperature and relative humidity affording the same degree of comfort are said to produce the same *effective temperature*. The condition of maximum comfort seems to be in the vicinity of 65° F. Eff. T., a condition obtainable with various dry-bulb temperatures by varying the relative humidity. See the comfort chart on page 212.

There are objectors, as might be expected, to this philosophy of comfort evolved by the heating and ventilating engineers. The New York Commission on Ventilation, in its final report recently issued, states that "we of this Commission are not all in accord as to the theoretical soundness of the 'effective temperature' concept. . . . The effective temperature index has, however, made it possible to determine and to express in a single factor the usual minor variations from any established optimum conditions for comfort."

Health and not optimum comfort was the basis of the New York Commission's study, which, of course, was concerned with school ventilation. We find, therefore, in the conclusions of this report the opinion that "the major objective of schoolroom ventilation is the provision of such atmospheric conditions as will facilitate the elimination of heat from the body surface without the production of objectionable drafts. In practice, this means the maintenance of a room temperature of 68° to 70° F. with moderate air movement. *Under such conditions, special control of humidity is not essential, except perhaps in certain northern regions where humidity is exceedingly low in cold weather.*" [Italics ours.]

These findings about schoolroom conditions may, in the main, be applied to residences with the resultant conclusion that if health is the criterion, humidification is not generally required. Even from the standpoint of comfort, we find the Commission expressing the opinion "that moderate variations in relative humidity do not affect the sensation of comfort at ordinary temperatures. In the schoolroom the ordinary thermometer is our best guide."

The propaganda now being broadcasted to prove that the incidence of respiratory disease in the winter derives from the low humidity conditions in our homes and buildings is an unwarrantable assumption. It is just as reasonable to conclude that the increase is the result of a decrease in the sale of Palm Beach suits.

Prospective buyers of humidification equipment should read the final report of the New York Commission, entitled "School Ventilation, Principles and Practices," and in addition "Humidification for Residences," by Alonzo T. Kratz (Bulletin No. 230 of the Engineering Experiment Station of the University of Illinois). The latter report, among its other conclusions, says:

"Relative humidity of 40% indoors cannot be maintained in rigorous climates without excessive condensation on the windows, unless tight-fitting storm sashes or the equivalent are installed.

"The problems of humidity requirements and limitations cannot be separated from considerations of good building construction. . . . If these factors are not considered, and the purchase of humidification apparatus made solely on the basis of expected evaporative performance, the result is liable to end in disappointment."

Specialty Craft

RUSSELL OWEN'S news dispatches from the Antarctic indicating that the Byrd Expedition would, if necessary, look to Norwegian whalers for rescue, brought descriptions of these peculiar and seldom heard of vessels to the front pages of the New York *Times* and other dailies two winters ago. The largest of these floating whale factories, the S. S. *Kosmos*, it transpired, had a gross tonnage over half that of the *Mauretania*, while in length she was a duplicate of the *Malolo*, which at the time was the fastest liner in service on the Pacific. In operation, the *Kosmos* acted as a mother-ship for an airplane, used to spy out whales, and for seven small, steam-operated "catcher" boats, while her electrically operated refinery and compressor was in constant readiness to "blubber" a catch within 15 minutes after it hit the deck.

Besides the whale factories, floating canneries are used to some extent in the crab and salmon fisheries of North Pacific waters. However, these are not the sole

industries for which particularly designed ships have been built. Specialized carriers have been constructed for many cargoes having the fairly common fundamental purpose of lessening transportation costs through hastening the loading and discharging processes. In addition to keeping a ship on the move, they shorten the time taken for "turn rounds" and thus lower port and labor charges.

Perhaps the earliest example of a steamer built for a specific purpose is afforded by the 417-ton *Leviathan*, which the North British Railway put in service in 1849 to transport trains across the Firth of Forth. Since then many car ferries have been built for inland waters, the largest on record being the *Contra Costa* of 1914, a wooden vessel of 4,483 gross tons, employed by the Southern Pacific to carry trains across Carquinez Straits in California before the Martinez-Benicia bridge was completed in 1930. Other important examples of interesting design are the screw ferries *Dolores de Urquiza* and *Schwerin*. The former carries trains of the *Entre Rios* Railways about 50 miles on the Parana River in the Argentine, while the latter is operated by the *Deutsches Reichsbahn* across an arm of the Baltic between Warnemüde, Germany, and Gjedser, Denmark. The *Schwerin* is equipped to burn oil or coal, and can carry 18 freight cars, or seven passenger coaches, and 800 persons.

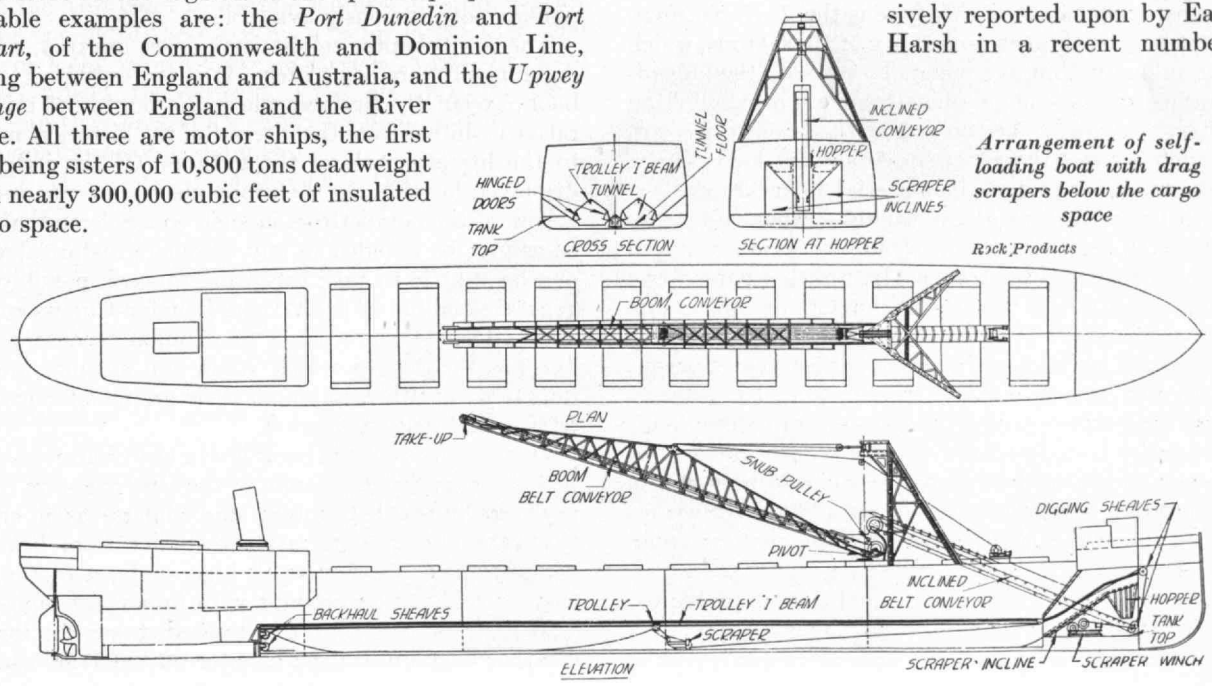
About three years ago Over-Seas Railways put in service between New Orleans and Havana, the S. S. *Seatrain*, a train ferry of a new type which utilizes more completely the ship's cargo capacity. Instead of cars being rolled straight on rails on the deck of the *Seatrain*, they are lifted from the pier by means of a 150-ton crane and a cradle which is fitted with tracks. After being lowered through a hatchway, a car is removed from the cradle and stowed upon a track in the hold by a mechanical car puller. This *Seatrain* can carry 95 cars of average size on her three decks.

Meat-carrying ships with refrigerated holds are also prominent on the register of the specific-purpose fleet. Notable examples are: the *Port Dunedin* and *Port Hobart*, of the Commonwealth and Dominion Line, plying between England and Australia, and the *Upwey Grange* between England and the River Plate. All three are motor ships, the first two being sisters of 10,800 tons deadweight with nearly 300,000 cubic feet of insulated cargo space.

Assembled automobiles, locomotives, and other railway rolling stock, as well as other heavy, uncrated, export shipments go overseas in bottoms particularly arranged for such purposes. The S. S. *Tractor*, now over six years old, is one of three ships ranging in capacity from 200 to 600 set-up autos, operated by the Arnold Bernstein Steamship Company. Loading is accomplished over a movable gangway, the automobiles passing through side ports on their own wheels, then to be lowered into the holds by means of interior elevators. The *Belpariel* is one of eight ships of the Christen Smith Company, equipped to handle entire locomotives, tenders, and passenger or freight cars. On one voyage from the United States to Brazil she carried: two 60-foot mail cars and two 60-foot baggage cars in her afterhold; thirteen 70-foot coaches, three 72-foot parlor cars, and two 83-foot diners over the hatches thwartships; and the trucks of these 22 all-steel cars in her forward hold.

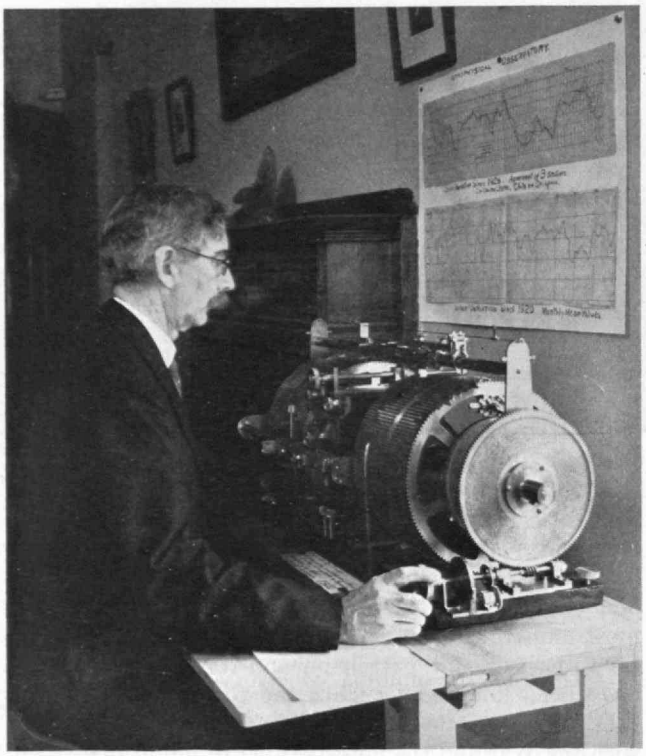
However, it is in vessels fitted primarily for handling bulk cargo, such as oil, crushed stone, gravel, sand, coal, and cement, that naval architects have rendered the most numerous examples of specialized tonnage. Tankers to carry crude petroleum and its various products have been known ever since the *Gluckauf* of 1886, although the amazing fecundity in tanker building began with the War and the increased use of liquid fuel afloat. World tanker tonnage, which in 1914 was less than one and a half millions, rose to five millions by 1922 and is now over eight and a half millions, or about an eighth of all tonnage in use. Besides petroleum carriers, there are now tankers for molasses and vegetable oils.

On the Great Lakes, bulk freighters have reached a high development. They vary from the one extreme of the whale-backed tanker or grain carrier, where loading and unloading equipment is customarily absent so far as the ship is concerned, to "self-unloaders," which can discharge their cargoes entirely independent of any or all shore plant. The latter vessels, of which there are upwards of 70 with a total cargo capacity of more than 280,000 tons, are comprehensively reported upon by Earl C. Harsh in a recent number of



Arrangement of self-loading boat with drag scrapers below the cargo space

Rock Products



Charles G. Abbot, '94, Secretary of the Smithsonian Institute, and the harmonic analyzer he has developed for discovering and evaluating periodicities in solar variation. It is to be used in long range weather forecasting and is another example of the machines that are being developed to do the menial work of thinking *(see The Review for January, page 171)*

Rock Products. As he points out, they probably account for the fact that shipments of crushed stone on the Great Lakes increased over five-fold between 1914 and 1929.

Early self-unloaders, such as the *Hennepin* of 1902 and the *Topeka* of 1905, used a system of belt conveyors below the cargo space. These discharged the material to an inclined conveyor and thence to another belt conveyor mounted on a boom swung out over the dock. The most recent boat of this type is the *J. R. Sensibar*, 556 feet long, with a cargo capacity of 10,000 tons, which it can unload within five hours. To increase the unloading radius of the boom, some ships have installed an auxiliary "thrower" at the end of the boom conveyor. One such device, the Stephens-Adamson, heavy-duty, box car unloader throws the material 30 or 35 feet.

With the patenting of the tunnel-scraper system by Leathem D. Smith in 1923, self-unloaders were judged feasible for ocean use. Under Mr. Smith's patent two or more longitudinal tunnels are built in at the bottom of the ship's hold. They are hoppered so as to be self-cleaning and have hinged doors on either side to permit the cargo to slide into them. In each tunnel a crescent-shaped drag-scoop, pulled by a system of cables, hauls the material to a hopper which feeds into an inclined conveyor and boom belt conveyor such as described in the preceding paragraph. The latest addition to vessels of this type is the *H. F. De Bardeleben*, used in ocean commerce on the Gulf of Mexico as a coal carrier.

The above types of self-unloaders are adaptable for crushed stone, gravel, coal, or sand, though a type with suction pumps and pipe lines instead of conveyors is often used for sand. Bulk cement is handled in the most up-to-date way in ships which feed, either by the tunnel-scraper system or by means of screw conveyors below the cargo, to Fuller-Kinyon pumps which force the material ashore through pipes or to a bucket elevator and then to a screw conveyor which carries it ashore.

Engineers Who Can Write

FOR those who would understand the significance of science and technology and their place in society, there is probably no better approach than the historical. The two books commented upon below, one a history of aviation, the other of communication, serve as admirable examples of history as a path to appreciation and understanding. Both of them are written by men trained as engineers and they are, therefore, technically sound. Moreover, by being well written, they demonstrate that the technician can be articulate, although deplorably few of them are.

SCION OF "SKYHIGH"

A HISTORY OF AIRCRAFT, by F. Alexander Magoun, '18, S.B., S.M., and Eric Hodgins, '22, S.B. $5.00. xx+495 pages. New York: *Whittlesey House, McGraw-Hill Book Company.*

The great bulk of this book, due to its organization and thoroughness, should really serve for all time as the backbone for aeronautical history down to 1914. Especially noteworthy are the treatments of helicopters, ornithopters, and parachutes, types of aircraft which have never before been systematically traced through their developments. Balloons, airships, and planes are also handled with what is certainly wider coverage than any preceding work. It is only fair to previous authors of real ability, however, to point out the tremendous advantage Magoun and Hodgins have had in the shape of such material as the Smithsonian bibliography, the general literary product of the last ten years' intense interest in aeronautics, and from collections of *aeronautica* not previously available.

The first chapter might have been omitted, or else done much more completely. It is the only part of the book, except the preface, where the burden of the narrative is shifted from the interest of the historical matter to the literary style of the authors. Of the judgment displayed in weighing the probability of events and the merits of the competitors in such controversial matters as cannot be avoided in any complete historical work, one finds little to take exception to save, possibly, the general handling of the Wright-Langley-Curtiss controversy. The present work is what might be described as not pro-Wright, to which stand the authors are undoubtedly entitled, although their grounds for arriving at it might well be debated.

One weakness of the book lies in the treatment of the last 15 years. Even in some of the best chapters (let us say parachutes, helicopters, and gliders) as it crosses the 1914 line, the narrative dwindles from beautiful completeness to a few weak high spots, a footnote or two, or perhaps an account with important omissions. The same period, generally treated, takes the form of a rather over-Fokkerized chapter on the War, which is

not up to the rest of the book, and a summary record of all the recent stunt flights down to Post and Gatty, with some exceptions. As long as the attempt was frankly being made to carry their completeness to the present year, it is unfortunate that there is nothing on the post-war development of commercial aviation or on post-war design. Suggested chapters for the second edition would include some account of the development of altitude flying, speed racing (such as the contests for the Schneider Cup), and other features of airplane performance besides sporadic cross-country flying.

Despite these minor lacunæ, the book and the work which has gone into it undoubtedly must be ranked with the previous efforts in England of Cavallo ("History and Practice of Aerostation," London, 1785), Vivian and Lockwood Marsh ("History of Aeronautics," New York, 1921), and Hodgson ("History of Aeronautics in Great Britain"), and in this country of Chanute ("Progress in Flying Machines," New York, 1909), and Zahm ("Aerial Navigation," New York, 1911). The large number of general volumes in this field which have been published in the past five years have contributed little in new matter, thoroughness of scholarship, or quality of treatment. Most of them are rehashes of the aforementioned classics. It is refreshing that Magoun and Hodgins have given us something scholarly and valuable.

DANIEL C. SAYRE

A HISTORY OF MESSAGE-SENDING

COMMUNICATION, by David O. Woodbury, '21. $2.50. 280 pages. New York: *Dodd, Mead and Company.*

If a person talks by telephone from Chicago to New York, his voice must be amplified a hundred billion billion billion billion billion times (10^{47}) as it travels the 800-mile course. If he talks from San Francisco to Europe, the required amplification is so preposterously great that it is necessary to combine astronomy and atomic physics to find a measure of the magnitude.

To use a current analogy, the process of transmission from the west coast to Europe requires an amplification of the energy of the voice by a factor larger than that by which the known universe exceeds in size the tinest known object, the electron. These are appalling figures, but they suggest a measure for man's advances in communication technique.

It is this story of achievement that Mr. Woodbury relates, and in a manner enabling all to understand. In a rapid and readable style, he has traced the history of communication "from a simple interchange of signs or sounds between individuals face to face to a vast and complicated network of channels, through which the messages of whole nations pass to every corner of the earth with the speed of light."

Of course, the real advance in communication technique came with the application of electricity, and the invention and development of telegraphy, telephony, and wireless occupy the major portion of the book. Other chapters, such as "The Story of the Mails," "Special Applications of Communication," "Images Through Space," "Communications in the World War," serve to round out the history of message-sending.

Mr. Woodbury achieves the difficult feat of popularizing without vulgarizing. In such a book attenuation is unavoidable; it is impossible to present more than the high lights, and vast amounts of material must be left untouched. The only really disappointing omission was the lack of credit to Oliver Heaviside for his fundamental contributions to telephony. Pupin, his debtor, is mentioned at length, but the more colorful, interesting, and brilliant Heaviside is mentioned only because he gave his name to the Heaviside layer.

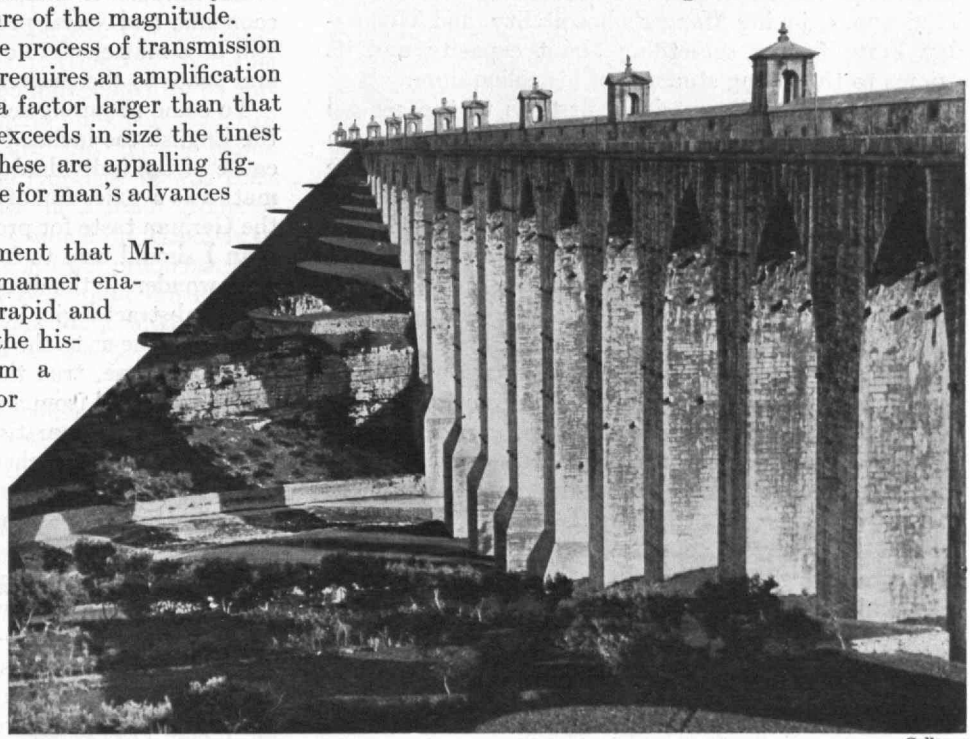
J. R. K., JR.

Vacuum Glass Insulation

LAST July The Review described glass bricks and their use in building construction and mentioned at the same time a glass block with a hollow interior from which the air is exhausted.

These vacuum glass blocks can be used most profitably for window openings, skylights, and as a lining for masonry. Tests have indicated that heat losses through vacuum glass in British Thermal Units per degree difference in temperature per hour may be less than the heat loss through a 40″ concrete wall and less than the heat loss through two inches of cork.

In addition to the high insulating qualities of these blocks, they also possess great powers to arrest sound. Hollow building blocks of Pyrex glass are also available in America. These blocks have surface patterns designed for controlled distribution of light.



The aqueduct of Aguas Livres supplies Lisbon, Portugal, with water. It was constructed in the early Eighteenth Century

Galloway

TRANSATLANTIC

The Shattered Nerves of Europe

AFTER my somewhat scanty budget of last month, I now find myself so overburdened by a wealth of impressions that I must needs exceed the 750 words of my normal allotment. As to the physical facts of my trip: we left Cambridge on the fifth of December for the Continent, by way of Harwich and Hoek van Holland. From there I called up Schouten at Delft. He asked about his friends at M. I. T. and exacted a promise that I should call at Delft on a later visit. We proceeded to Hamburg, where we were treated with great hospitality by Blaschke and Artin. I hoped to be able to run up to Kiel to visit Robert Schmidt, but time was too short, and Schmidt looked us up in Hamburg instead. On the ninth, I lectured to the Mathematical Club on Tauberian Theorems. Hecke was present — also a young assistant Petersen, who seems to have a very promising future — and they took part in the discussion. The next day we went on to Berlin, where I parted from the rest of the family, proceeding to Vienna via Prague, while they continued to Breslau. Menger met me early on the morning of the eleventh, and after resting, I gave another lecture, this time on Harmonic Analysis. Professor Hahn was present and took part in the discussion. Afterwards we had a *Nachsitzung* at a nearby café, where I met the Vienna mathematicians, besides Frank of Prague (German university) and Miss Wrinch of Oxford. I had the pleasure of sitting beside Professor Tauber, after whom Tauberian theorems are named. The next day I met Professor Wirtinger, who asked after many American friends. I am at present still in Vienna, enjoying Menger's hospitality, and Wednesday I am to say something about capacity and its axioms to the young students of his colloquium.

Now as to my impressions: first, as to the general situation in Germany and Austria. Naturally, they can only be superficial, and are rather an account of the reaction of the people I have met than of the actual situation, whatever that may be. The reaction is one of depression, of hopelessness, almost of resignation. Everyone awaits a crash, no one knows from what direction it will come, and no one of my friends has the least expectation that any *coup d'état*, whether from the right or from the left, will appreciably better matters. I have not been able to discern much enthusiasm for Bolshevism, but what is growing on all sides, with few exceptions, is a consciousness that the present economic order has played itself out. Perhaps the best expression of this point of view was made to me by Haldane at Cambridge. He said that if anyone could persuade him that the equations governing the capitalistic system had a stable solution, containing no exponentials in the time with exponents with positive real part, he would vote conservative from then on, but that since he was convinced that there is nothing to prevent economic cycles from becoming progressively more extreme, he was forced to be a socialist. In any case, there is a widespread feeling that only in a world-wide, planned, economic system can there be any security, and that the era of free competition is dead, and only awaits a decent funeral.

The misery among the German lower classes is intense, and the situation threatens to become as bad in Austria. As to the intellectuals, the strain of a continually uncertain future is telling hard on them. It is impossible to have peace of mind in the Germany of today — perhaps I should say in the world of today, although the older English universities furnish a fair approximation. In Germany there is a continual suppression of assistantships, cutting of salaries, and no man knows one day what is in store for him on the next. What is even worse than personal discomfort and suffering is the uncertainty of the whole order of things, so that no one is sure whether the whole European culture of which he is a part and for which he is working may not be crossed out with a few strokes of a dictator's pen, or effaced by the bloodshed of a revolution.

The situation is so bad that it has gone far beyond the stage of resentment and hatred. The German intellectual has almost come to accept the intransigence of France as an objective fact, ruinous to Germany, but to be accepted without much emotional reaction, because France is only one step behind Germany on the way to economic ruin, and it is a case of *sauve qui peut*. If by some miracle it should become possible to restore economic and social prosperity to the world, it would still be a matter of 20 or 30 years to restore confidence and peace to the shattered nerves of Europe.

To come to purely scientific matters: if I have found the English too inclined (for my taste) to champion the cause of the individual problem, and to regard mathematics as a collection of puzzles, I must also admit that the German taste for programs and schools goes further than I should care to follow it. The Vienna school has done wonders in the direction of the theory of dimension and of abstract logic, but to my notion they are a little over-sanguine as to the power of postulational methods. It is, of course, true that every mathematical system may be deduced from a set of first principles, but in the practice of the axiomatists, these first principles tend to take on a severely schematized and formalized shape. To demand that every mathematical system should be deducible from a set of postulates of predetermined type would be much like demanding that every function should satisfy an algebraic differential equation of finite order — which we know to be false. An instance in point is that of electro-static capacity. Menger's first reaction was that this point-set function could be axiomatized in a fashion similar to that in which he had already treated measure and (*Concluded on page 220*)

THE INSTITUTE GAZETTE

A Portrait of Major Briggs

A PORTRAIT of the late Major Frank Harrison Briggs, '81, for years a leader in the development of athletics at Technology, was exhibited for the first time at a private showing in the Office of the Dean on January 8.

The portrait, done in oils, is the work of Emil Pollak-Ottendorff, Boston artist, who painted the well-known portrait of the late Dean Talbot. It has been presented to the Institute by the Alumni Advisory Council on Athletics, which was founded by Major Briggs in 1898, 17 years after his graduation from the Institute. Major Briggs was the first chairman of the Advisory Council on Athletics, and later was its treasurer. From his early days at the Institute until his death on April 8 of last year, Major Briggs' interest in college athletics was unflagging, and the significance of his influence upon sports is well indicated by the inscription on the portrait. It reads:

"By precept and example, he inculcated, developed, and exemplified those high ideals of true sportsmanship which are the sound basis of human relations; with far-seeing vision, he conceived and advocated those principles of conduct which today are developing and moulding the youth of this country."

Major Briggs came from an old New England family, famous on Cape Cod as builders of ships in the days when Massachusetts sent sailing vessels to every port in the world. He himself became a leather merchant, and at his death was the sole remaining member of an old Boston firm.

In 1897 when Major Briggs undertook the establishment of the Advisory Council on Athletics, sports at Technology were being carried on independently by undergraduate captains and managers. Financing athletics under this procedure was difficult, and various teams were in debt for equipment and trophies. It was then that Major Briggs, moving spirit of a small group of Alumni, proposed the Advisory Council on Athletics to aid the students in solving some of their problems. It is interesting to note that the policies laid down then by him are those which, with but slight modification, are the basis of the guiding principles of athletics at Technology today.

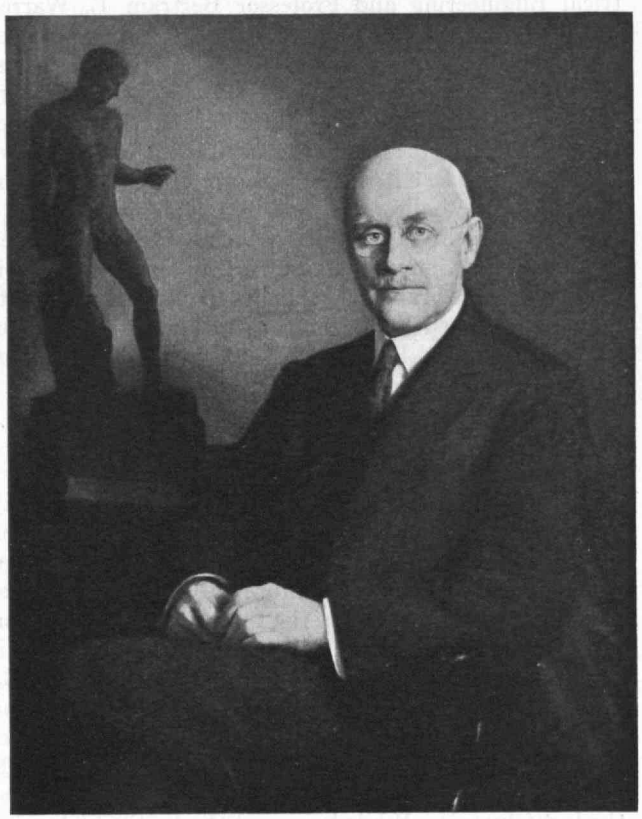
It was Major Briggs' vision which anticipated and advocated such advances as the freshman rule, intramural competition, and many other practices which are commonplaces of college athletics of the present, years before they were recognized and accepted by the college world at large. It has been said of Major Briggs that he more than any other single individual was responsible for the standardization and rationalization of college athletics.

Among those who came to the showing of Major Briggs' portrait were members of the Faculty and Corporation of the Institute, the Advisory Council on Athletics, sports writers, and present and former college athletes.

A Service for Electrical Engineering Alumni

WHILE the Institute does not formally operate any university extension or alumni education program, it has various components following a procedure which virtually amounts to such a program. The Technology Review, for instance, makes available to Alumni information about scientific work at the Institute and elsewhere. The Seminars held in New York and Pittsburgh in coöperation with the various courses of the Institute constitute another method for keeping Alumni informed. A third method has been admirably used by the Department of Electrical Engineering.

This Department keeps in close contact with its graduates and sends out from time to time bulletins which might be of assistance to them in their work. Material which has been sent out heretofore consists of a pamphlet entitled "Bibliography of Bibliographies in Electrical Engineering, 1918–29"; Department Bulletins No. 74 and No. 75; a Log-Log Vector Slide Rule chart, prepared by Professor Carlton E. Tucker, '18, for use in connection with the Puchstein-Wein-



A portrait of the late Major Frank Harrison Briggs, '81, executed by Emil Pollak-Ottendorff

bach Slide Rule; Complex Hyperbolic Function Charts prepared by Professor Louis F. Woodruff, 2d, '18, covering the power transmission range; and Vail Library Bulletins.

This undertaking was begun in September, 1931, and has been received with appreciation by many of the Institute men who are in electrical engineering teaching. The Department is anxious to include on the mailing list all the men who have studied in electrical engineering at the Institute and who are teaching. If any such individual has not received the material sent out in September and November, it is an oversight in the mailing list and will be rectified upon notification to that effect being sent to Professor Dugald C. Jackson, Head of the Electrical Engineering Department.

Alumni Dinner

EVERY Alumnus who can get to Boston is invited to be present at the Annual Dinner of the Alumni Association on the evening of February 6. It will be held at the Hotel Statler.

There is to be a reception before the dinner, beginning at 6:15, in the Assembly Room, adjacent to the main ballroom at the Statler. At this reception Alumni and their guests will have an opportunity not only to meet each other, but to meet officials of the Institute and Corporation as well.

During the course of the dinner, the Van de Graaff 1,500,000-volt generator will be exhibited and described for the first time in Boston. In addition to this there will be another scientific demonstration staged by Professor Ralph D. Bennett of the Department of Electrical Engineering and Professor Bertram E. Warren of the Department of Physics.

The speaking program consists of only two speeches; one by President Compton on the educational policy of the Institute, and the other by Dr. Allan Winter Rowe, '01, on undergraduate activities. After these two addresses, the last items on the program, there will be dancing in the ballroom.

Alumni are invited to bring their wives and women friends. The Committee on Assemblies considers it particularly desirable that ladies be present. Tickets may be obtained by calling or writing to the Alumni Association office, Room 3–225, M. I. T. The price per person is $4.00.

Olympic Tryouts

ALUMNI of the Institute will have an opportunity to see some of the nation's finest fencers in action on the evenings of February 10 and 11, when the National Olympic Foils tryouts are to be held in Walker Memorial. In these tryouts the Institute will be particularly well represented. The present national champion is George C. Calnan, '23, and the runner-up is Joseph L. Levis, '26. Levis has been runner-up for four years and national champion for one. He holds the further distinction of being the only American to have reached the finals of an Olympic Foils match, a feat he achieved at the last Olympics. While he was at the Institute, he won the intercollegiates twice.

Levis will participate in the trials at Walker Memorial and there are entries from M. I. T., Harvard, Boston College, Boston University, Boston Athletic Association, and the New York Clubs. In addition to these scheduled foils tryouts, there will be exhibition matches in sabre and epée. Georgio Santelli of New York, Olympic sabre coach, Robert Grasson, coach at Yale, and Rene Peroy, Harvard Coach, have been engaged to perform in the exhibition. Tickets may be obtained by writing or calling the Alumni office. The price per ticket is $1.00 which gives admission to both evenings.

TRANSATLANTIC

(*Concluded from page 218*)

dimension. To me this seemed highly improbable, owing to the fact that the group of capacity has only a finite set of parameters, while the other notions have much more extensive groups. I finally won Menger over to my way of thinking, at least tentatively.

I do not think it at all an accident that many of the mathematicians of the abstract school are at the same time enthusiastic admirers of the more modern directions in art. The modern woodcut, with its sharp contrast of whites and blacks, its severely schematized faces and landscapes, buildings and machines, waves and clouds, its universal moral or social lesson, its thoroughgoing suppression of all suppressable detail, is the precise counterpart of the gaunt, stark, logical skeleton which is all that the abstract schools would leave us. To one of my somewhat naïve intellectual make-up, who likes art to have a little more of the pictorial and a little less of the symbolic than is now the fashion, who rereads his Thackeray a 50th and 60th time — to such a solitary straggler from the Nineteenth Century, a mathematical work cannot be fully satisfactory unless it possesses a certain body and substance, a certain wealth of concrete results, a certain complex interlocking of formulae to give well-rounded theorems — in short, a certain content. However, *de gustibus* —.

The Hamburgers — I am speaking of the analysts, for the canons of geometrical taste are for me a sealed book — seem to have their feet pretty well on the ground. Artin — he is dean at 30 — works more in an algebraically number-theoretic direction, but his powers in analytic number theory are immense. Hecke represents more of the Hardy-Littlewood standpoint. At both Hamburg and Vienna I observed a number of exceedingly keen youngsters, and if working conditions remain reasonably tolerable, the mathematical productivity is provided for for some time to come. Indeed, I hear complaints everywhere that the bad times are sending to the universities thousands of students who never can hope for suitable positions, and who form a discontented intellectual proletariat. Only the unusual man can succeed.

Next month I shall write about Prague, Leipzig, and possibly Berlin. Then, back to Cambridge once more!

NORBERT WIENER

ANNOUNCING

A NEW

TELETYPEWRITER SERVICE

THE BELL SYSTEM offers to the public a new Teletypewriter Service. Any subscriber to this service may be connected, through the teletypewriter "central," to any other subscriber, whether he be around the corner or across the continent. Subscribers can type back and forth by wire, for short or long periods, just as they now hold conversations by telephone.

This important development for the business world parallels the other progress which is constantly being made in the telephone art.

Messages, inquiries, reports — typed in one office—are instantly and accurately reproduced on the other subscriber's teletypewriter. Typewritten copies made by both sending and receiving machines are available for permanent records. The principal feature of this new service, which distinguishes it from existing private line teletypewriter service, is that any subscriber may ask for any other subscriber and be connected immediately.

Further information about this new development in nation-wide communication will be furnished gladly by your local Bell Telephone Business Office.

Teletypewriter Service provides two-way communication.
Speed of connection is as fast as telephone service.
A typewritten record, one or more copies, is produced simultaneously by both sending and receiving machines.
Material transmitted may be recorded on forms if desired.
Teletypewriters are like ordinary typewriters in appearance.
Teletypewriters can be operated by any one who can operate a typewriter.
You can use Teletypewriter Service any time you need it.
A most economical form of record communication.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

If You Expect INFALLIBILITY *don't read this*

This message is addressed to executives and investors who realize that *infallible* business and investment forecasts cannot be purchased at any price. If you agree, however, that expert forecasts, backed by a 12-year record of "better-than-average" accuracy, should help you to increase your business and investment profits, consider what UNITED BUSINESS SERVICE has to offer you.

What UNITED *Brings You*

Each Monday morning UNITED Business and Investment Reports place before you a quick, accurate picture of business and financial conditions — also trustworthy Sales, Credit, Commodity and Security Forecasts, with *definite* recommendations. All forecasts are based on the unique UNITED OPINION Method of forecasting.

Why UNITED OPINION *is More Accurate*

The opinions of our own experts alone would merit your confidence. Yet UNITED OPINION gives you more than this. It presents the carefully checked, weighted and balanced opinion of all recognized economic authorities. You get greater accuracy — the benefits of many services at less than the cost of one.

At Our Expense A MONTH'S FREE TRIAL

UNITED Business and Investment Reports *themselves* can most effectively prove their own value. Many of our 5,000 clients became acquainted with this dependable advisory service through our MONTH'S FREE TRIAL offer. We gladly extend this same privilege to you. Just send the coupon below and these Reports will come to you for a month, *without cost or obligation.*

UNITED BUSINESS SERVICE

United Business Service Building — 210 Newbury Street Boston, Mass.

United Business Service
210 Newbury Street, Boston, Mass.

Please send me the Weekly UNITED Business and Investment Reports for a MONTH'S FREE TRIAL ,so that I can personally test their value.

Name.....

Address.....

ENGINEERS AS CITY PLANNERS

(*Concluded from page 200*)

extraordinary stimulus to German city planning. In these settlements, an outcome principally of the great work of the Ruhr district, was shown what great economic, social, and scenic advantages can result when the quarters are planned and projected on a large scale. Dwelling construction following this scheme has constantly increased and resulted in the erection of rentable homes which are not single houses but great buildings with accompanying recreation grounds.

The liberation of dwelling construction from historical bonds, in particular from the enclosed block form of the Eighteenth Century, and the carrying out of the "row" method with its mechanical location of buildings and streets, has opened to engineering still another broad field.

At present many scientific investigations are concerned with the proper location of buildings with regard to entrance of sunlight and air based upon varying width and relation to the meridian.

Further researches deal with the possibility of rational opening out of living districts and their complete isolation from traffic routes to insure quiet and freedom from dust. Still others seek to establish a ratio between floor area of dwellings and the sum of public and private free ground area, to avoid a too heavily settled section in residential districts.

The work of the engineer in the field of city planning is directly proportional in its growth to the rate at which modern municipal design is freed from historical influences. Thereby is shown to an ever-growing extent that simplification and articulation, brought into the present-day city picture by the engineer, meet with a natural process of crystallization of the city organism. The way to technical clarity proves to be a way to beauty, which happily solves the problem of harmonious incorporation of the modern city with the surrounding landscape.

BACK TO LEIBNIZ!

(*Continued from page 203*)

to mathematical physics; namely, the principle of least action. This principle, which to the present day is central in quantum theory as well as in the more classical forms of mathematical physics, was a direct deduction from the metaphysics of Leibniz. Leibniz asserts that this world is distinguished from other possible worlds by the realization of some perfection. Maupertuis asks himself what perfection the Newtonian physics actually realizes. In the course of these investigations, it becomes apparent that a certain quantity formed by the integral of the energy with respect to the time, and known as the action, is smaller over the actual path of a particle than over any possible alternative path. Accordingly, Maupertuis takes this to be a sign that God in creating the world has done it with the greatest possible economy of effort.

From one standpoint, this is utter anthropomorphic trash, but it leads to sound physics and originates from a very profound principle, which has modified the entire course of science. This conception (*Concluded on page 224*)

ESTABLISHED 1818

Brooks Brothers,

CLOTHING,

Gentlemen's Furnishing Goods,

MADISON AVENUE COR. FORTY-FOURTH STREET
NEW YORK

Clothes for Travel or Sport in the South

SWEATERS
$6.00 to $29.00

GOLF STOCKINGS
$2.50 to $12.00

BRANCHES
NEW YORK: ONE WALL STREET
BOSTON: NEWBURY COR. BERKELEY STREET
NEWPORT PALM BEACH

ROTOGRAVURE
PRINTING

A Complete Rotogravure Department, the first installation in New England by a commercial printing firm, is now in full operation at our plant. This new department is equipped to produce ROTOGRAVURE PRINTING in any desired form and quantity. A complete service, including photography, art work and copy writing, is available. It is our intention to produce ROTOGRAVURE PRINTING of quality comparable to that of our book, catalog and general commercial printing.

THE MURRAY PRINTING COMPANY
KENDALL SQUARE · CAMBRIDGE

TELEPHONE 5650 UNIVERSITY

Walker Memorial Dining Service

Meals Served During the Academic Year for Any Type of Technology Alumni Gathering

CLASS DINNERS GIVEN SPECIAL ATTENTION

The recreational facilities can be made available if desired

Menus submitted upon request

Address

A. W. Bridges, Walker Memorial, M. I. T., Cambridge, Mass.

BACK TO LEIBNIZ!

(*Concluded from page 222*)

of the world as one of a system of possible worlds is vital to the whole of modern mechanics. In the form of the principle of least action, the other possible worlds are introduced merely to be rejected, for they do not satisfy the desired principle of minimization. On the other hand, in a statistical mechanics — the quantum theory reduces the whole of physics to a form of statistical mechanics — these other possible worlds are considered from the standpoint of probability. To put it crudely, the propositions of statistical mechanics assert nothing about any individual possible world, but rather about the overwhelming majority of all of them. This concept, without which modern physics could not have assumed anything like its present form, is a definite part of the philosophy of Leibniz.

UP TO the present, we have chiefly emphasized the resemblances between Leibnizianism and modern physics. It is worth while pointing out that there is one point in which he is more remote from the modern standpoint than was Newton. This point concerns the relativity of motion. It is, of course, a mistake to attribute to Einstein the origination of all considerations as to the relativity of motion. There is a Newtonian relativity just as well defined as that of Einstein and quite analogous to the latter. Indeed, Einstein's chief service has been to show how the Newtonian relativity of rest and motion, which had been compromised by the phenomena of light and electromagnetism, may be supplanted by another form of relativity, in which mechanical phenomena are electromagnetic corollaries.

Now, Leibniz's metaphysical prejudices did not permit him a whole-hearted acceptance of Newtonian relativity. As his monads were self-contained substances, each containing the causes of its entire future history, and as he viewed these causes as of the nature of energy, it became necessary for him to localize energy in individual particles. However, neither Newtonian nor Einsteinian relativity permits the sharp localization of energy.

Nevertheless, Leibniz did play with the idea of relativity — in his less consistent moments — and in one respect went further than Newton. Newtonian relativity, like the special relativity of Einstein, is a relativity as regards uniform translation, but not a relativity as regards rotation, or as regards accelerated motion. There is a real distinction between the shape of the surface of the water in a bucket when it is whirling and when it is at rest, and this cannot be explained away by any transformation of coördinates, without the introduction of new forces. Leibniz felt, nevertheless, that there was some way of treating the distinction even between rotation and rest as relative, and in this history has substantiated him. It was a consideration of this type which led Einstein to seek the meaning of gravity in the geometrical nature of the space-time world, and which was responsible for the concept of general or gravitational relativity.

In conclusion, it may be worth our while to ask why it is precisely Leibniz who is of interest to us in our present phase of physics and why it is exactly our present phase of physics to which the work of Leibniz is relevant. The answer to this is to be found in the fact that Leibniz and the present generation of physicists frame the period of the triumphant success of Newtonian theories. Leibniz's precise physical views were almost immediately eclipsed by the compact Newtonian system which enjoyed 200 years of unquestioned acceptance and ever-increasing achievement. It was not until the beginning of the present century that the technique of physical observation became sufficiently developed to suggested serious shortcomings in Newtonian mechanics. Leibniz wrote at the termination of the pre-Newtonian period of groping and confusion, and it is now the post-Newtonian period of groping and confusion in which we are enveloped. Thus, we are again prepared to find more suggestion in general philosophical considerations than in a great finished discipline which the years have squeezed dry. Leibniz wrote unprejudiced by the success of a single theory, and we again find it necessary to escape from the blinding glare of a theory to see our physical universe face to face and free from prejudice.

ATHLETICS AND HEALTH

(*Continued from page 211*)

as more susceptible to injury through exercise, a position which he reaffirms in a later communication.[4] This point of view is dealt with by White [19] who states

> Physical work and exercise do not cause heart disease although they may precipitate or aggravate symptoms and signs of heart diseases already present and may temporarily exhaust the cardiovascular reserve even in a healthy individual.

In this, as in an earlier article,[20] he regards as unsettled the question of cardiac hypertrophy resulting from exercise. The following excerpts may be quoted:

> There is still some doubt about the possibility of the heart's enlarging as the result of exercise. Abnormal hearts undoubtedly may enlarge, both acutely and chronically, but the normal heart probably increases only a little in size at most; its reserve is great. DeMar . . . shows no cardiac enlargement . . . ; there may be slight enlargement of the heart in professional cyclists, oarsmen and ski-racers.
>
> The poor physical condition resulting from total abstinence from exercise is not conducive to the best of health.
>
> The so-called *athletic heart*, as I have seen it, has consisted simply in effort syndrome or in an 'irritable heart' in a nervous overtrained or undertrained person and not in heart disease.

Bock [23] has also made numerous studies on the physiology of exertion and in them has included records from DeMar, the marathon runner. He points out that:

> It has been shown that glycogen is the sole source of muscular energy. During moderate work the transformation of fat is going on to keep the Respiratory Quotient low. If heavy work is done, then little fat can be utilized, glycogen is used almost entirely, and the Respiratory Quotient tends to approach one. Demar works better not only because of increased space for diffusion in his lungs, the better heart action, etc., but the muscle cells are able to take care of products of increased metabolism without losing them into the circulation, causing fatigue.

Reid [24] in his book on the heart analyzes a large amount of data and concludes that the heart is not the sole factor in enabling the body to accomplish physical labor.

(*Continued on page 225*)

NATURALLY *FRESH*

never parched, never toasted!

The cool, flavorful *freshness* of Camel cigarettes is purely a natural product.

It is attained not by any mysterious processes, but simply by preserving the full natural goodness of fine sun-ripened tobaccos.

These choice tobaccos of which Camels are blended — fine Turkish and mild Domestic tobaccos — are never parched or toasted.

On the contrary we exercise every care and precaution to safeguard the natural moisture which is infused with their mildness and flavor.

That's why the Camel Humidor Pack is such a boon to Camel smokers — it could do little or nothing except for the fact that the cigarettes we put into it are fresh to start with.

To see what that means in cool, smooth, throat-friendly smoking pleasure, switch to *fresh* Camels for just one day — then leave them, if you can!

R. J. REYNOLDS TOBACCO COMPANY, *Winston-Salem, N. C.*

R. J. Reynolds Tobacco Company's Coast-to-Coast Radio Programs

CAMEL QUARTER HOUR, Morton Downey, Tony Wons, and Camel Orchestra, direction Jacques Renard, every night except Sunday, Columbia Broadcasting System

PRINCE ALBERT QUARTER HOUR, Alice Joy, "Old Hunch," and Prince Albert Orchestra, direction Paul Van Loan, every night except Sunday, N. B. C. Red Network

See radio page of local newspaper for time

© 1932, R. J. Reynolds Tobacco Company

● *Don't remove the moisture-proof wrapping from your package of Camels after you open it. The Camel Humidor Pack is protection against perfume and powder odors, dust and germs. In offices and homes, even in the dry atmosphere of artificial heat, the Camel Humidor Pack delivers fresh Camels and keeps them right until the last one has been smoked*

CAMELS

***Made* FRESH — *Kept* FRESH**

FROM M. I. T. TO CALIFORNIA

UNIVERSITY GRADUATES AGREE IN THEIR PREFERENCE FOR

BUICK

Graduates of leading American universities are Buick enthusiasts. In fact, so great is their preference for Buick that the number of Buicks in their garages nearly doubles the number of cars of the second make selling at comparable prices. Graduates of M. I. T., for example, own 19 Buicks for each 9 of the second make. Alumni of Northwestern and Wisconsin own 21 Buicks for each 8 of the second make. And on the west coast, at California, Stanford and Southern California, the ratio is two Buicks for every one of the second car.* Buick takes more than passing pride in the preference for its cars revealed by this distinguished group of thinking people; for the various alumni organizations are made up of men and women capable of appraising accurately the value of any products they buy. And Buick feels certain, too, that the new Buick Eight with Wizard Control, priced from $935 to $2055, f. o. b. Flint, will win even greater acceptance among college graduates — for the new Buick represents the greatest value which Buick has ever offered.

** Facts concerning the ownership of Buicks by graduates of 15 leading universities were compiled by the Graduate Group of alumni magazines and by the alumni associations of the universities.*

WHEN BETTER AUTOMOBILES ARE BUILT, BUICK WILL BUILD THEM . . . PRODUCT OF GENERAL MOTORS

THE NEW BUICK *with* WIZARD CONTROL

ATHLETICS AND HEALTH

(*Continued from page 224*)

. . . it is now realized that dilatation of the heart may be a purely physiological process, and thus the fear of this feature has been much lessened.

Elsewhere he analyzes the mechanism of cardiac response to exercise.

There is evidence that during exercise there occurs a dilatation of the peripheral blood-vessels, produced in large part at least by the coöperation of the nervous system, probably a reflex through the depressor fibers of the vagus nerve. This dilatation of the peripheral stream bed causes a more rapid drainage of blood away from the heart, and lessens the rise of pressure in the first part of the aorta, and also the height of that which must be achieved in the left ventricle before the aortic valve can be forced open. During exercise, therefore, the heart is thus enabled to contract without strain.

The studies of Himwich and Barr [25] offer material confirmatory of these last general conclusions.

The mobility of red corpuscles with their oxygen-carrying hemoglobin, the stretching of the alveolar membranes through the more vigorous breathing, and the consequent better diffusion into the lung, all contribute to enable the blood to retain more oxygen.

Indeed the investigations of Himwich and Barr lead them to the unanticipated conclusion that perhaps the severity of the exercise that a normal person will tolerate may be determined by the amount of oxygen that can diffuse through the lung membrane rather than by the capabilities of the circulation.

Most recently, a very thorough and comprehensive survey of many of these problems has found place in the authoritative revision by Bock and Dill [26] of Bainbridge's well-known treatise on the physiology of muscular exercise. But a few excerpts among the many need be quoted.

At the risk of repetition it is worth pointing out again that no system or mechanism in the body can be isolated from the whole, but that as a general principle the entire body participates in reactions which lead, through training, to greater physical power.

Consideration of two great systems in the body serves to indicate that the question of exercise is not concerned alone with the problem of breathing or the capacity of the heart. Too much emphasis has in the past been applied to the question of heart strain, the heart being considered as the limiting factor in exercise.

The limit of exercise has often been ascribed to the capacity of the heart alone, but the facts as a whole indicate that the sum of the changes taking place throughout the body brings about the final cessation of effort.

The better coördination of movements, which is brought about by training, also improves the mechanical efficiency of the body. The effect of these changes is not only to increase a man's power, but also to enable him to carry out his work, whether heavy or light, with the greater economy of effort.

It is concluded that there is no evidence at present that the longevity of athletes is altered by physical training and participation in sports.

To summarize briefly, the question of cardiac enlargement as the result of competitive exercise would still seem to be unsettled. On the other hand, hypertrophy, should it occur, does not seem to connote cardiac disease *per se* and there would seem to be an unanimity of opinion that exercise does not produce heart disease. Further injury to an already injured heart is conceded; the initiation of a morbid (*Concluded on page 226*)

Meet M. I. T. Men Here

THE Technology Club has its headquarters in New York at the Allerton —38th Street and Madison Avenue. You can always count on meeting M. I. T. men and men from other colleges at the Allerton Houses in New York, Chicago and Cleveland.

College men like the atmosphere. They like the idea back of Allerton Houses..."Live in NINE Rooms... Pay for ONE". The comfort and sociability of an exclusive club without initiation fees or dues.

You pay for your bedroom...and at one or more Allerton Houses you have the use of comfortable Lounges, Reading Rooms, Solarium, Roof Garden, Squash and Tennis Courts, Gymnasium, Exercise Rooms, Showers, Billiard Room, Indoor Golf Course, Library and Restaurants.

Stop for a night...or live at an Allerton House for economy, comfort, sociability. Select the one that suits your convenience...all will suit your purse.

Rates: $12 to $20 a week
Transient Rates: $2.50, $3.00

ALLERTON

New York Cleveland

EMPIRE STATE

ELEVATORS are the highways of this metropolis along which the public must be transported quickly and safely.

The SPEED, 1200 ft. per minute, is the fastest ever used for elevators. SAFETY under these conditions requires dependable equipment.

B.I.W. furnished part of the electric cable requirements for the elevators in this building. Two types, Control and Annunciator Cables are attached to and travel with the elevator. The Control regulates the movement; the Annunciator signals the position of the elevator.

B.I.W. for twenty-five years has given special attention to the manufacture of electric cables for elevators and always with the purpose of making the best cables possible.

B.I.W. cables are in service in many of the principal buildings in the cities of the U. S. and Canada, also in South America and Japan.

PROGRESS makes necessary new constructions and specifications especially to meet the demands in higher buildings and new operating conditions. B.I.W. is prepared to furnish dependable products and advice.

BOSTON INSULATED WIRE & CABLE CO.
BOSTON, MASSACHUSETTS, U. S. A.
Canadian Plant, Hamilton, Ont.

MERRIMAC CHEMICAL COMPANY *Inc.*

Division of Monsanto Chemical Works

EVERETT MASSACHUSETTS

THE LARGEST AND OLDEST CHEMICAL CONCERN IN NEW ENGLAND

Founded in 1853

ATHLETICS AND HEALTH

(*Concluded from page 225*)

process is denied. The only recent dissenting voice is that of Dublin [7] who bases his opinion on a statistical analysis, the details of which present anomalous and self-contradictory features.

From this it would seem to the dispassionate observer that, in the health control of college athletics, it is only necessary to insure the prospective contestant from existing cardiac pathology. The medical examination by a competent practitioner, specially trained in this field and utilizing such additional laboratory procedures as modern science has contributed to modern medicine, should prove a wholly effective insurance against an unwise indulgence. To deny any healthy lad participation in competitive sport, that most normal and wholesome of recreations, would seem to be unwarranted. By safeguarding the unfit, the field is left open to the boy who can derive only health and pleasure from the exercise of his physical powers.

[1] Schumacher and Middleton, *Journal American Medical Association* (1914), 62–1136.

[2] Lee, Dodd and Young, *Boston Medical and Surgical Journal* (1915), 173–499.

[3] Meylan, *Harvard Graduate Magazine* (1904), 12–362 and 543.

[4] Cole, *American Physical Education Review* (1928), 33–571.

[5] Greenway and Hiscock, *Yale Alumni Weekly* (1926), 35–1086.

[6] *J.A.M.A.* (1926), editorial, 87–175.

[7] Dublin, *Harper's Magazine* (1928), 157–229.

[8] Gordon, Levine and Wilmaers, *Archives Internal Medicine* (1924), 33–425. See also, Gordon, *American Journal Roentgenology* (1925), 14–424.

[9] Richards, *J.A.M.A.* (1930), 93–1988.

[10] Buytendijk, *Ergeb. d. Sportartzlichen Untersuch. b. d.* IX Olymp Spiel in Amsterdam (1928). Reviewed, *J.A.M.A.* (1930), 95–1950.

[11] Herxheimer, *Zeitschrift Klinische Medizin* (1923), 96–218.

[12] Ibid., *Klinische Wochenschrift* (1924), 3–2225.

[13] Hahn, Herxheimer and Brose, *Deutsche Medizin Wochenschrift* (1925), 51–892.

[14] Herxheimer, *Klin. Woch.* (1926), 5–749.

[15] Ibid., (1929), 8–402.

[16] Dedichen, *Acta Medica Scandinavica* (1921), 53–738.

[17] Barringer, *J.A.M.A.* (1921), 76–1143.

[18] Cole, *American Phys. Ed. Rev.* (1922), 27–475.

[19] White, "Heart Disease" (Macmillan: New York, 1931).

[20] Ibid., *New England Journal Medicine* (1928), 199–801.

[21] Dwight, "The Next Job in Preventive Medicine," *Life Insurance Medicine* (New England Life Insurance Co.: Boston 1926), p. 22.

[22] Farrell, Langan and Gordon, *American Journal Medical Science* (1929), 177–309.

[23] Bock, *N. E. J. Med.* (1928), 198–269.

[24] Reid, "The Heart in Modern Practice" (Lippincott: Philadelphia, 1928), second ed., 369 and 357.

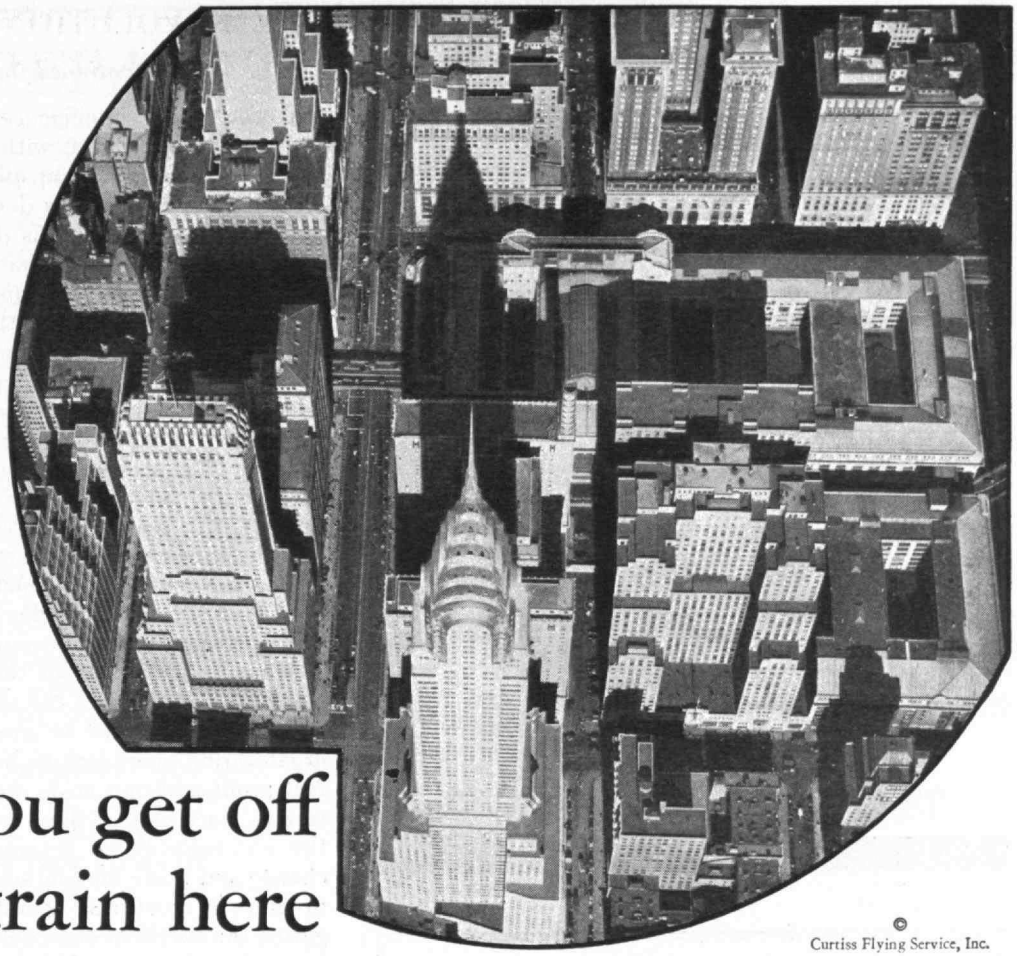
[25] Himwich and Barr, *Journal Biological Chemistry* (1923), 57–363, quoted in *J.A.M.A.* (1923), editorial, 81–.

[26] Bainbridge, "The Physiology of Muscular Exercise" (Longmans, Green: London, 1931), third ed., rewritten by A. V. Bock and D. B. Dill.

Let The Technology Review Book Service
Order Your Magazines and Books
ADDRESS ORDERS TO
ROOM 11-203, M.I.T., CAMBRIDGE, MASS.

Unusual air view of the vicinity of The SHELTON, *the Grand Central District, showing Chrysler Bldg. in the foreground.*

Directly opposite New Waldorf Astoria



© Curtiss Flying Service, Inc. Photo Division

When you get off your train here

—you are but 5 minutes from *The* SHELTON, New York's most famous club hotel

Most popular among comfort-loving travelers. Where guests may enjoy an invigorating plunge in the beautiful Shelton Swimming Pool, at any hour and without charge. Where you find all the service that can be given by a metropolitan hotel of the first class—and an unusual club-like atmosphere that has endeared *The* SHELTON to travelers from every section of the world. You will like *The* SHELTON—it is different—and such a relief from the ordinary hotel.

Daily Rates Reduced
$2.50 per day without bath
$3.00 per day with bath
$4.00 per day double with bath

Besides the swimming pool there is a gymnasium, completely equipped; game rooms for bridge, chess, roof garden; solarium; library and reading room; four beautiful lounges; yet room charges are no higher than in other hotels where the most you can expect is a "room and bath."

The SHELTON
49th and Lexington Ave. New York

The COPLEY-PLAZA Boston

Recognized as one of the finest hotels in the world, richly furnished, modern in every respect . . . located in historic Copley Square, probably the most accessible and attractive spot in Boston.

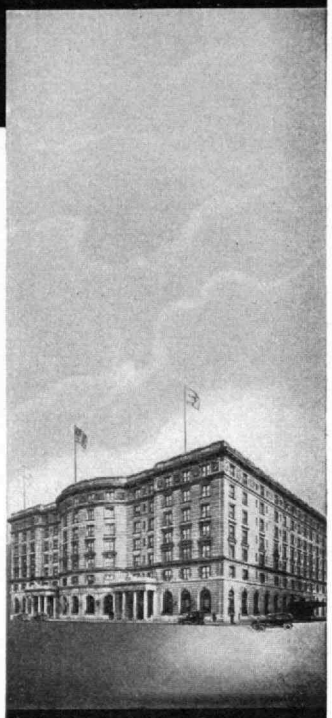
Rooms $4 and up.

ARTHUR L. RACE
Managing Director

Tea Dances every Wednesday and Saturday afternoon —4:30 to 7

Supper Dances nightly

Music, Meyer Davis Le Paradis Band, direction of Joe Smith



HOTEL OF DISTINCTION

THE RUMFORD PRESS
Concord, New Hampshire

Makers of Magazines and Books of Distinction

William H. Coburn & Co.
Investments

68 Devonshire St. Boston, Mass.

THE REVOLUTION ON THE RIALTO

(*Continued from page 208*)

the coördinated intelligence of an entire organization into a plan of action, with a view to examining the effect of this plan upon all phases of the enterprise. If any undesired results develop, modification is then possible before the plan is put into effect. The budget adopted becomes a standard against which actual accomplishment may be compared and variations noted.

The rapid decline over the last two years, in both prices and volume of trade, emphasizes the effect of such change on the individual enterprise. Inventory losses and unused capacity costs dominate the business picture. They cannot be avoided, since the business must have plant capacity sufficient for normal business and inventories determined by length of manufacturing process, the seasonal characteristics of the industry, and the time needed to obtain goods from vendors, as well as the volume of production. Attempts to eliminate or at least segregate the effects of these forces constitute an important trend in accounting control.

Management must act through men. Authority carries responsibility and the success with which the trust is administered must be measured if weak links in an organization chain are to be found and strengthened. Net profit and unit costs are not infallible measures of results, since both of these are tremendously affected by the non-controllable economic forces behind a price change and trade fluctuations. Accountants are making progress in measuring operating results, first by segregating the effects of non-controllable forces and, second, by paying closer attention to the fundamental principle that accounts must parallel organizational responsibility.

The cost of marketing industrial products is increasing. In order to assist in the control and reduction of marketing costs, accountants are applying the principles of accounting analysis and control to the field of marketing costs.

RECENT TENDENCIES IN FINANCE

By F. E. Armstrong
Professor of Political Economy

CHANGES are taking place in the financial control and management of corporations quite comparable to the amazing developments in the technique of production and marketing. Some of these changes are concerned with the detailed work of internal financial control, among which may be mentioned the slowly developing use of the trade acceptance, the shortening of the terms of settlement on commercial credit, and the widespread recognition of the need for, and the rather general adoption of, adequate systems of budgetary control. The really outstanding developments, however, are those which have taken place in external organization and management, and in the financial institutions on which business relies for aid.

Prominent among such changes and developments is the increasingly large number of cases where active control and management is quite completely divorced from the responsible proprietary interest. (*Concluded on page 230*)

PREPARATORY SCHOOLS

Watch this space for an announcement regarding a new type of school combining the best features of the eastern preparatory school, the modern military school, and the western ranch school. For information write P.O. Box 1143, Benson, Arizona.

BERKELEY PREPARATORY SCHOOL

(Established 1907)

Special Preparation for M. I. T. Half-year students admitted Feb. 1, 1932.

GEORGE HOPKINSON, *Principal*
HARRY F. CADE, JR., '28, *Asst. Principal*

1089 Boylston Street, Boston Tel. Com. 9262

California Preparatory School

FOR BOYS

Thorough training in scholarship and physical development. Junior College. College Preparation. Lower School. Athletics. Music, Riding, Swimming and Golf.

Address, THE HEADMASTER Box T Covina, California

CHAUNCY HALL SCHOOL

Founded 1828. The School that confines itself exclusively to the preparation of students for the Massachusetts Institute of Technology.

FRANKLIN T. KURT, *Principal*, 553 Boylston Street, *Boston, Mass.*

DWIGHT SCHOOL

72 Park Avenue, New York City
College and Regents' Preparation. 51st Year

ERNEST GREENWOOD, *Headmaster*

FRANKLIN AND MARSHALL ACADEMY

A Widely Recognized, Moderately Priced, Preparatory School. Wholesome School Life and Sports. Unusual Equipment and Location. 1200 Boys prepared for college in the last 30 years.

E. M. HARTMAN, Pd.D., Principal, Box 450, Lancaster, Pa.

HEBRON ACADEMY

The Maine School for Boys. A College preparatory school of high standing. Graduates in 22 Colleges. Strong Faculty of thirteen men. Athletics for all. Finest school skating rink in America. Fine dormitories for all.

RALPH L. HUNT, Principal, Hebron, Maine

HUNTINGTON SCHOOL FOR BOYS

Five Forms. Special two-year course for entrance to M. I. T.
Summer Session Send for catalogue

CHARLES H. SAMPSON, Ed.M., Headmaster

320 Huntington Ave., Boston *Tel. Kenmore 1800*

MANTER HALL SCHOOL

71A Mt. Auburn Street, Cambridge, Mass.

Founded in 1886. Intensive Preparation for College Entrance. New dormitory accommodations. Staff of well-known specialists with years of successful experience.

MOSES BROWN SCHOOL

An Endowed New England School with an excellent record in preparing boys for leading colleges. 25-acre elm-shaded campus. Athletic Fields. Gymnasium. Swimming Pool. *For Illustrated Catalog Address:*

L. RALSTON THOMAS, Headmaster, 257-A Hope Street, Providence, R. I.

NORTHWOOD SCHOOL

In the heart of the Adirondacks. Under Lake Placid Club Education Foundation. Unusual success in college preparation. Emphasis on recreation that can be continued thruout life. Winter sports. Separate junior school for boys, 8 to 12.

IRA A. FLINNER, Ed.D., Director, Box T, Lake Placid Club, N. Y.

THE POND SCHOOL

Separate Instruction of Each Student. Supervised Study under Instructors. Training in the most effective Methods of Study and Concentration. Rapid and Thorough Preparation for College.
W. McD. POND, Headmaster, 42A Quincy St., Cambridge, Mass.
Porter 1971

ROXBURY SCHOOL

CHESHIRE, CONNECTICUT

A small College Preparatory School that has sent 250 boys to leading colleges in five years.

A. N. SHERIFF, *Headmaster*

SHATTUCK SCHOOL

A Church school for boys. 72nd year. Stands high among schools for sound scholarship, manly character and Christian citizenship. Military training. Sends boys to M.I.T. each year.

Address *The Headmaster*, Faribault, Minn.

STAUNTON MILITARY ACADEMY

Superb disciplinary training equaled by academic excellence. Prepares thoroughly for all colleges and for citizenship. Examination center for College Entrance Board.

COL. THOMAS H. RUSSELL, B.S., LL.D., *President*
Box 11, Staunton, Va.

ST. JOHN'S PREPARATORY SCHOOL

DANVERS, MASS.

A Country School, Eighteen Miles from Boston. Preparing Catholic Boys for College and Technical School. Every Modern Facility for Student Life. For catalog or personal interview

Write to PRINCIPAL: St. John's Preparatory School, Danvers, Mass.

THAYER ACADEMY

Every year the Academy sends a group of students to Technology. Recognized by Technology alumni as an exceptionally good fitting school. Both day and boarding pupils accepted. *For catalogue address*

STACY B. SOUTHWORTH, Headmaster, South Braintree, Massachusetts

TILTON SCHOOL

Prepares thoroughly for technical institutions and colleges. 87th year. Well endowed, moderate rates. Excellent facilities. Three hours from Boston. Separate Junior School. Correspondence and inspection invited. Catalog.

T. W. WATKINS, Headmaster, Tilton, N. H.

WORCESTER ACADEMY

SAMUEL F. HOLMES, *Headmaster* GEORGE D. CHURCH, *Registrar*

96th Year. 250 Boys. $1000-$1200. Unusually well equipped for Science and Mathematics. Kingsley Laboratory exclusively devoted to these two departments. *Write for descriptive catalogue*—Station 125, Worcester, Mass.

WYOMING SEMINARY

College-Preparation, Business, Secretarial Course and Music. Coeducational. $800. a year. 88th year. Buildings $1,000,000; endowment $1,000,000. Catalogue.

L. L. SPRAGUE, D.D., L.H.D., President
Kingston, Pa.

THE REVOLUTION ON THE RIALTO

(*Concluded from page 228*)

American corporations afford numberless examples of the almost complete separation of the proprietary interest from the group who exercise the power of selecting the active management. The situation has operated to contravene our whole philosophy of proprietary control, which is based upon a proper balancing of the rights, duties, and responsibilities which attach to the ownership of private property. Moreover, ownership — true proprietorship — is, by this development, reduced to a state of dependence on those who exercise the functions of management and control. Disenfranchised owners, like the detached labor groups, have seen their power and strength pass to those in whose hands rests the control of the means of production.

Most of the important changes that have taken place on the financial side of industry during the last decade, are traceable to the culmination of the long price cycle which began in the nineties, reached its peak in 1920, was extended beyond its time by the post-war speculative boom, and finally crashed to present extreme low levels during the year just closed. The closing phase of this price change was accompanied by a world condition which brought America over half of the existing supply of monetary gold and furnished the base for an almost limitless expansion of credit. In this set of circumstances may be found the influences which have brought about a vastly over-extended plant development, a veritable flood of corporate securities that have grossly overcapitalized normal earning power, the emergence of numerous non-economic ventures under the pressure of redundant capital and credit-seeking employment, the growth of unwise (not to say unsound) banking associations in the form of security affiliates and investment trusts, and finally an expansion in foreign investments quite beyond the limits set by sound business judgment.

Such an array of somber details forms a rather dismal picture. But the inexorable and irresistable laws of economic behavior are even now at work bringing order out of what seems to be chaos. Slowly, by the painful process of elimination, over-expansion of plant capacity is being corrected. This process is retarded by the important fact that though the company may fail the plant remains, and after a financial readjustment and with a greatly reduced burden of capitalization, it emerges as a more severe competitor than before. The larger the proportion of capital invested in plant and equipment, the slower the adjustment through economic depression.

Gradually, however, the corrective process is going on. The enlarged stock and bond issues which were put out to keep pace with the rising profits that always accompany a period of advancing prices will be scaled down to a level commensurate with normal earnings. Many corporations will go "through the wash;" others will effect voluntary retirements of a part of their capital obligations; while others will reverse the stock split-up game and consolidate their outstanding shares on some convenient and proper ratio.

Leading American corporations took advantage of the new era, when common stocks were being feverishly bought as investments, to retire their funded debt. Many converted their surpluses into cash or cash equivalents and we have today the unusual spectacle of numerous companies whose shares are selling in the market for but little more than their net working assets. Such companies are, therefore, in an excellent position to take advantage of the business revival which is certainly ahead of us. The banking situation is fundamentally sound and is in a fair way to correct the errors of the recent past. The financial structure of American business will emerge from the present painful period safe, sturdy, and strong.

Transits and Levels are used on all largest works and by U. S. Govt. for utmost precision.

New catalog, just issued, sent gratis

BUFF & BUFF CO. **Boston 30, Mass.**

Handsome nickle bas-relief of a Buff Transit sent gratis to engineers

HARVARD ENGRAVING CO.
MAKERS OF FINE
PRINTING PLATES
ENGRAVERS ILLUSTRATORS
72 LINCOLN ST. Cor ESSEX BOSTON MASS.

HAMILTON L. WOOD, '17
INSURANCE OF EVERY DESCRIPTION
Associated with
FIELD & COWLES, 40 BROAD STREET, BOSTON

CHARLES H. JOHNSON
M. I. T., '05
New England Mutual Life Insurance Company
80 FEDERAL STREET *Liberty 0553* BOSTON, MASS.

FREDERICK BERNARD, '17
Special Agent
NORTHWESTERN MUTUAL LIFE INSURANCE CO.
235 PARK SQUARE BUILDING BOSTON, MASS.

PROFESSIONAL CARDS

JACKSON & MORELAND

ENGINEERS

BOSTON , NEW YORK

H. K. BARROWS, '95

M. Am. Soc. C.E.

CONSULTING HYDRAULIC ENGINEER

Hydro-electric developments — Water supplies. Reports, plans, supervision. Advice, appraisals.

6 BEACON STREET , BOSTON, MASS.

EADIE, FREUND AND CAMPBELL

CONSULTING ENGINEERS

110 WEST FORTIETH STREET NEW YORK CITY

PLANS AND SPECIFICATIONS — EXAMINATIONS AND REPORTS

Power, Heating, Ventilating, Electric, Plumbing, Sprinkler, Refrigerating, Elevator Installations, etc., in Buildings and Industrial Plants

J. K. CAMPBELL, M. I. T. '11

METCALF & EDDY, ENGINEERS

HARRISON P. EDDY
CHARLES W. SHERMAN, '90
ALMON L. FALES
FRANK A. MARSTON
JOHN P. WENTWORTH, '10
HARRISON P. EDDY, JR., '17
ARTHUR L. SHAW, '09
E. SHERMAN CHASE, '06

Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Laboratory

STATLER BUILDING BOSTON, MASS.

THOMAS B. BOOTH, '95 AMASA M. HOLCOMBE, '04
JOSEPH Y. HOUGHTON, '26

Emery, Booth, Varney, and Townsend 50 Congress St., Boston
Emery, Booth, Varney, and Whittemore 60 E. 42nd St., New York
Emery, Booth, Varney, and Holcombe 900 F St., Washington

PATENT LAWYERS

Merton L. Emerson

Management Engineer
Associated with

Scovell, Wellington & Company

Accountants — Engineers

BOSTON NEW YORK CHICAGO

ARCHIBALD H. SPAULDING '14 PHILIP B. TERRY, '13

SPAULDING-MOSS COMPANY

"Reproduction Specialists"

Blue Prints Photostat Prints Planograph Prints

BOSTON LIBerty 3000

FAY, SPOFFORD & THORNDIKE

ENGINEERS BOSTON, MASS.

BRIDGES WATER SUPPLY AND SEWERAGE
PORT AND TERMINAL WORKS
FIRE PREVENTION
INVESTIGATIONS DESIGNS
SUPERVISION OF CONSTRUCTION

STANLEY G. H. FITCH '00

CERTIFIED PUBLIC ACCOUNTANT
of PATTERSON, TEELE & DENNIS
1 Federal Street, Boston, Mass.

AUDITS INVESTIGATIONS

New York , Boston , Washington , Baltimore

MAURICE A. REIDY

Consulting Engineer

STRUCTURAL DESIGNS FOUNDATIONS
CONSTRUCTION CONSULTANT AND ARCHITECTURAL ENGINEER
Estimates and Appraisals

44 SCHOOL STREET BOSTON, MASS.

CHAS. T. MAIN, INC.

ENGINEERS

Industrial Buildings, Electrical, Steam and Hydraulic Engineering
Valuations and Reports, Consulting Engineering

201 Devonshire Street Boston, Mass.

H. STOKES WAITE

B.A. Harvard 1909 B.Sc. M.I.T. II 1911
Kon. Tech. Hochschule, Charlottenburg 1912 A. Member Inst. of Civil Engineers
M. Societe des Ingenieurs Civils de France Fellow Royal Geographical Society
Asso. Mem. American Chamber of Commerce. London

CONSULTING ENGINEER

Financial and Industrial Investigations Technical and Commercial Reports
Selection of Works Sites Industrial Plants
Hydro-electric and Steam Power Developments
IN GREAT BRITAIN AND CONTINENTAL COUNTRIES
17 Victoria Street, Westminster, London S.W.1., England

EDWARD A. GRAUSTEIN

Consulting Engineer

Hydraulic — Structural — Civil — Hydroelectric Developments
Investigations — Court Work — Design and Supervision
Soils Testing Laboratory

6 Beacon Street Boston

George W. Fuller
J. R. McClintock

FULLER & MCCLINTOCK

F. G. Cunningham
C. A. Emerson, Jr.

ENGINEERS

NEW YORK — 170 Broadway
PHILADELPHIA — 42 South 15th Street

Water Supply and Water Purification
Sewerage and Sewage Disposal
Disposal of Industrial Wastes

Investigation of Epidemics
Garbage Collection and Disposal
Valuations of Public Utilities

Division of Industrial Coöperation and Research
Massachusetts Institute of Technology + + + Cambridge

RESEARCH

Through this Division the Institute's Laboratories and the services of its Staff are made available for problems not adequately provided for in the usual equipment of consulting engineers and industrial research laboratories.

Inquiries regarding the service should be addressed to the Division.

PERSONNEL

In the interest of Employers and of Alumni the Division maintains a List of Graduates with records of their experience and special qualifications for technical positions.

There is kept also a List of Positions Open.

Inquiries regarding the service should be addressed to the Personnel Department of the Division.

Division of Industrial Coöperation and Research
Massachusetts Institute of Technology + + + Cambridge

M. I. T. NEWS BULLETIN

PREPARED BY JOHN J. ROWLANDS, DIRECTOR, INSTITUTE NEWS SERVICE

Earthquake Speedometer

THE Science Department of the Associated Press recently carried a description of a new seismometer being developed at the Institute. The article, written by Howard W. Blakeslee, Science Editor of the Associated Press, follows:

"An earthquake meter, to catch what man's instruments never yet have fully recorded, the force exerted by a great quake at its center of destruction, is under construction at the Massachusetts Institute of Technology.

"This meter is a new type of seismometer. Ordinary seismographs are too sensitive for recording at the center of a quake. The new instrument is peculiar in that it records the 'acceleration' of the earthquake, which means the rate of change of speed of the ground as it quakes.

"The practical purpose of the seismometer is to take the guesswork out of construction of buildings in quake zones. The scientific purpose is the accurate measurement of the most destructive natural phenomenon known on earth, the quake wave at and near the epicenter, the place on the earth's surface where the convulsions center.

"The seismometer, or seismic accelerometer, was developed at Technology by M. W. Braunlich, research associate in seismology, who presented a paper on his work before the Philosophical Society in Washington on November 22.

"The starting device of the seismometer is almost as simple in appearance as a telegraph operator's 'key,' and it operates on much the same principle. Instead of the telegrapher's 'hand,' this quake key is operated by the push of an earthquake wave. Ordinary quake waves are like the telegraph operator's fingers when they rest lightly on his key. Their weight is insufficient to move the key. The operator must use a little muscle, a little of the weight of his 'hand.' Violent quake waves supply a similar extra push to start the seismometer. This start closes an electrical relay, which in turn sets in operation an accelerometer that will continue recording as long as the quake lasts.

"In earthquakes it is the rate of change of speed which is the source of the destructive effect. It is much like moving a pile of building blocks. If their base is moved slowly they do not fall, but a quick punch at the base block brings them all toppling down.

"In the violently disturbed areas of an earthquake the waves have this speedy punch. These systems of waves move with a velocity of about four and a half miles per second, but their destructive effect is due mainly to the sudden changes of motion set up in the earth by the passage of these waves. These accelerations are generally expressed as a percentage of the acceleration due to gravity, or the rate of change of speed experienced by a falling body, which is about 32 feet per second per second.

"When this acceleration reaches three per cent of gravity, that is, about one foot per second per second, it starts the quake meter. Although the instrument records only the accelerations, the actual motion of the ground can be computed from these data.

"In building for safety in earthquakes engineers allow for accelerations of three to six feet per second per second. This margin is based largely upon guesswork as to how fast the quake waves jerk to and fro."

Cosmopolitan Technology

A RECENT study of the student body of the Institute shows that of the total number of 3188 registered, 2994 come from every state in the Union except South Dakota. Twelve come from United States possessions, and 182 from 38 different foreign countries.

Alaska and the Canal Zone are represented by one student each, Hawaii sent five, the Philippine Islands three, and Porto Rico two.

The foreign students come from the following countries: Argentine Republic, one; Australia, two; Austria, one; Belgium, two; British West Indies, two; Canada, 34; Chile, one; China, 17; Columbia, six; Costa Rica, one; Cuba, 14; Czechoslovakia, one; Denmark, one; Ecuador, two; Egypt, one; England, three; France, four; Germany, five; India, six; Irak, two; Ireland, one; Japan, five; Lithuania, two; Mexico, 13; Norway, two; Palestine, four; Panama, three; Peru, three; Poland, one; Russia, 25; Salvador, two; Scotland, one; Siam, three; Union of South Africa, four; Spain, two; Sweden, two; Switzerland, one; Venezuela, two.

The Future of Building Construction

VARIOUS aspects of modern building construction were discussed at an Alumni Seminar on the Institute's Department of Building Construction at the Technology Club in New York on December 10. The work and objectives of the course were described by Professor Ross F. Tucker '92, Head of the Department, Professor Walter C. Voss, and Leonard C. Peskin of the staff.

The seminar was attended by nearly 50 alumni of Technology and their guests, among whom were Professor Theodore Crane of the course in building construction at Yale University, and Mr. Lazarus White of Spencer, White and Prentiss. Captain Richard H. Ranger '11, President of the New York Technology Club, presided at a dinner which preceded the seminar.

The need for special training for modern building construction was emphasized by Professor Tucker in the following address: "There was a time, not remote, when the builder was conceived of as a person who received a contract from the architect and then sat up nights to devise ways and means of avoiding the specifications. No doubt there are an abundance of that type now, but there is a trend toward a better condition. The builder is becoming more and more the associate of the architect.

"In fact, the tendency is growing, with informed owners, to sign the contract with the architect, the builder and perhaps the structural engineer simultaneously, before the drawings are made or the specifications written. The three, acting together, each in his special field, form a board of experts, charged with the responsibility of creating the structure to the owner's satisfaction, in the minimum of time and at the minimum of cost. This manifestly is the cheapest possible and the best possible way to build, when all of the experts are properly qualified.

"In the creation of the great structures with which our larger cities abound the element of time is governing, and the duties of the builder in the purchase, transportation, coördination, and direction of the many materials and the many crafts necessary to erect one of these great structures constitute a Herculean task. Again, the engineering problems incidental to the construction of one of these buildings in a congested locality, which problems are wholly the builder's, are major in their quality. The work below grade, involving the holding of banks and streets, the underpinning and protection of adjoining property, the sinking of piles and caissons, the blasting and excavation of rock are often engineering problems of the first order with which the architect and the structural engineer have little to do. When, as in the case of the Bank of Manhattan Building, the foundations were put down at the same time that the building went up, so that when the foundations were completed, the building was already 72 stories in the air, a feat of engineering was performed that called for professional knowledge and ability of the first rank.

"As our buildings get larger and higher and go deeper and deeper into the ground, the incidental engineering problems which are wholly the builder's and for

which he is solely responsible demand from him the best professional knowledge, judgment, and ability. Furthermore, the intelligent and efficient direction of work demands that he have a clear, technical appreciation of the architect's problems, and he must furnish to the architect an expert knowledge of the sources of supply, the qualities and properties of all materials that the architect may have in mind to use, and he must know how those materials are to be used and assembled in order to produce the structure that the architect conceives.

"Building is primarily and fundamentally the art of using materials with the greatest efficiency and the greatest economy. The further burden is laid upon the builder to build speedily and to build well. It is not difficult to build well if the time is allowed, nor is it difficult to build quickly if quality is neglected, but modern building economics demands both speed and quality and it looks to the builder to satisfy this demand. Again, a builder's efficiency depends upon a real understanding of the problem of the structural engineer, because without that understanding he cannot supply the coöperation that is necessary to get these great structures into the air with the accuracy, speed, and safety that the time schedule imposes. In other words, the modern builder, to measure up to the demands of the times, must have a profound knowledge of the science of materials, must be an administrator of parts, and an engineer of the best professional attainments.

"The building industry today stands on the threshold of an era of change. It is fairly presumptive that we have reached, if we have not already passed, the economic height in buildings, but we have far from exhausted the limits of steel.

"By the use of two or more city blocks, our buildings may be much larger and much higher, and the centralization of industry and the tendency toward consolidation of business indicates that they will be. But solution of this problem demands new materials and new methods. Our floor systems are too heavy, and attempts to lighten them are decreasing their fire-resisting ability. There seems to be no logical reason for building brick walls several hundred feet high merely to keep out the weather. Perhaps these things will be solved by the coming of the age of alloys, which will lighten our loads and still leave us the strength and rigidity necessary to carry our buildings two or three thousand feet higher.

"Again, in the field of the home, that touches the welfare of all our people, there is much to do. We still build the wooden house in much the same way as it has always been built, but not as well. We are wasting vast quantities of raw materials and of money in building these flimsy, short-lived structures, but at the moment we have nothing to replace them at a corresponding cost. No problem in science more closely touches the comfort and well-being of our people and no one is doing anything about it, because for the most part the problem is in the hands of men who have no training with which to attack it.

"Over 60 per cent of the dwellings sold in this country during 1929 were under $10,000 in value, and the greater part of these were built by so-called builders whose sole incentive was gain.

"The volume of dwelling-house building in a normal year exceeds two billion dollars. The greater part of it is done with no contact with the architect or the engineer whatever. The builder himself is not only lacking in any scientific knowledge of materials and their use, but often he is not even a craftsman. No qualifications, technical or otherwise, are required to be a dwelling-house builder except a hat for an office, and even that may be dispensed with. The result is a depreciation, amounting in some classifications, according to appraisers' statistics, to as much as five per cent a year. This loss falls not upon the builder who builds these houses but upon the people who buy them.

"The preventable wastes in building amount to a huge sum; they are a burden upon the resources of our people, financially, economically, and socially. The responsibility is directly the builder's, but indirectly it belongs to the people themselves.

"It has been decreed that no man may practice medicine until he can show evidence of his competency. In some states it is thought necessary to register architects and engineers, but the builder is for the most part a free agent. It is my opinion that it is within the public interest to also decree that no man shall be allowed to build until he can show that he stands four square on the motto of the Associated General Contractors — Skill, Integrity, Responsibility — in testimony whereof a license may be issued to him by competent authority.

"Building construction may be said to be the application of the science of materials to the art of building. The expression 'science of materials' may be new to you because we have learned very little about the scientific use of materials. For instance, steel has been a constructional material for fifty years, but it is only within very recent times that science has discovered what may be done with it in combination with other metals, and although only the surface has been scratched, the developments in this direction bid fair to revolutionize our building methods, and to make possible structures larger in size, lighter in weight, cheaper in cost, more quickly built, and different in architectural appearance from any that the world has yet seen.

"Let us take a more familiar and much older example. The world has been building in brick for several thousand years, and presumably, by this time, we ought to know how to make and lay brick. But ask the first architect you meet if he has ever had any trouble with the leaking of brick masonry. He will probably answer, 'Nothing else but.' As a matter of fact, leaky brickwork is a cause of constant complaint and is a defect of building that we have not learned how to correct. If a builder is fortunate enough to build a tight wall, it is likely that he will have a plausible explanation, but it is not at all likely that he will have the true one. Undoubtedly imperfect workmanship will account for a large part of the trouble, but not all of it. There is still an unknown quantity and until this is solved, we will not have watertight walls regardless of workmanship.

"It appears to me that it may be necessary to learn something about brick-making, and possibly the brick manufacturer will have to select his clays with the help of physical chemistry before he will be able to make the kind of brick we want in the building industry. That is one of the things that this course in Building Construction hopes to find out.

"The Course in Building Construction at the Massachusetts Institute of Technology was established for the purpose of supplying men to the building industry who may be expected to make the same contribution to our social and economic welfare in the field of building that the graduates of other courses in the school are making in their respective fields of activity.

"The chair was established through the generosity of Mr. Louis J. Horowitz, Chairman of the Board of the Thompson Starrett Company, and his wife, who set aside a large sum for the purpose of higher education in the art of building. Having risen to the position of one of the world's most successful builders and recognizing the many deficiencies of the industry, it was his desire to lend his support to their correction. In addition to Technology, he has also endowed chairs at Yale and at Union. It may be pertinent to observe that the British Institute of Builders has also recognized the necessity for the professional training of builders and has taken steps to install such a course in Cambridge University.

"You will note that the course as now developed is basically a course in structural engineering, with specialized training in the application of the science of materials to the art of building. These specialized courses, relating primarily to building, are taught within the department and are designated by 17 numbers. They fall into three groups and generally include the second, third, and fourth years.

"They are: first, 'Materials,' which is the keystone of the course; second, 'Building Construction,' which is the *assembly* of materials in accordance with what is known as the best practice, and in the *sequence* in which they are used in buildings of various kinds; third, 'Structural Design,' which is the tying in of mechanics and the Theory of Structures to the practical problems in engineering, with which the builder has most to do.

"Neither have we neglected the business side of the art of building. A course in Quantity Survey and Estimating is given in the summer at Camp Technology. In coöperation with the Department of Business Administration we have courses in Accounting, Building Finance,

and Business Management. Under Job Management we include job organization, superintendence, the handling of men, business relations, business ethics, credit, organized labor, and other subjects having to do with the human contacts which constitute so essential a part of a builder's experience.

"The course opens the door of opportunity in many fields of activity; in general building and in all of the industries which have to do with the manufacture and distribution of the materials and appurtenances of building; in the professions of architecture and engineering; in real estate, insurance, property management, banking and the law, in which a knowledge of the technique of building is collaterally of great importance.

"The undergraduate course is also fundamental preparation for graduate work in four special fields closely allied to building, and these we expect to offer as opportunity arises. These are:

(1) A course applying to General Building and its allied industries, including courses in Purchase and Supply, Traffic Management and Marketing, Sales and Finance, and Industrial Management.

(2) A course in Town Planning, Real Estate, and Insurance, including courses in Planning and Zoning, Ordinances and Building Codes, Property Valuation and Appraisement, Taxation and Assessment, and Banking and Finance.

(3) A course in the Management and Maintenance of Buildings, including courses in Valuations and Rental, Finance and Mortgages, Mechanical Maintenance (Heating and Ventilation, Plumbing Installation, Electric Installation, Elevator Installation), and General Maintenance.

(4) A course in the Science of Materials, consisting of research covering the properties and use of existing materials and the search for new materials. What has the chemist, the physicist, the geologist, found out that we can make use of in the art of building?"

Departmental Lectures and Colloquia

Electrical Engineering

Colloquia. — "Development of Instruments for the Direct Observation of Performance Characteristics of Communications Equipment," Mr. J. Warren Horton '14, Chief Engineer, Mr. W. N. Tuttle, Mr. James K. Clapp '23, Mr. Charles T. Burke '23, Mr. A. E. Thiessen, and Mr. Horatio W. Lamson '15, members of the engineering staff, General Radio Company, December 7 and 8.

"Induction Motor Design," Mr. Charles J. Koch '23, Induction Motor Department, General Electric Company, December 14 and 15.

Physics and Physical Chemistry

Physical Colloquia. — "L-Satellites of the Heavy Elements," Professor F. K. Richtmyer, Cornell University; "The Hyperfine Structure of Ba II Lines," Professor R. C. Gibbs, Cornell University; December 7 at Harvard University.

"The Sixth Meeting of the American Acoustical Society at Cleveland," Dr. Martin Grabau, Dr. Harry Hall, and Dr. Frederick Hunt, December 14 at Harvard University.

Physics Colloquia. — "Energy Losses of Electrons Bombarding Solid Conductors," Dr. Erik Rudberg, December 10.

"Structure of the Compton Modified Line," Dr. N. S. Gingrich; "Calculated Potential Energy Curve of the Normal Hydrogen Molecule," Mr. Nathan Rosen '29, December 17.

Theoretical Seminars. — "The Scattering of Light in Fog," Mr. H. Robinson, December 9.

"The Principle of Uncertainty," Mr. M. F. Manning, December 16.

Physical Society. — "Physics as a Career," Professor Arthur C. Hardy '18, December 8.

Chemistry Conferences. — "The Deamination of Some Amino-Alcohols, and the Migration of Hydrocarbon Radicles Involved," Dr. J. R. Myles, December 10.

"Steam Research at Technology," Professor Leighton B. Smith '19, December 17.

Harvard-Technology Seminar. — "Statistical Mechanics and the Vapor Pressure Constants of Gases, II," Dr. T. E. Sterne, December 8, at Harvard University.

Research in Photography

SKETCHING the events of his own scientific career under the title "Reminiscences," Dr. C. E. K. Mees, Director of Research and Development for the Eastman Kodak Company, delivered the first Aldred Lecture of the season at the Institute on December 4.

At Harrogate and St. Dunstan's Mees prepared to enter the University of London, where at 18 he enrolled for work under the great chemist of the period, Sir William Ramsay. Among Dr. Mees' most vivid recollections of his famous mentor is that of Ramsay in the act of blowing glass with a cigarette in his mouth.

Convinced, said Dr. Mees, of the advantages of getting into a branch of work about which little was known, he took up research in the theory of photography. Three years later, with a degree of doctor of science in research from the University of London, he was about to enter the teaching profession, when Ramsay, a great protagonist of industrial scientific research, urged him to enter the latter field. Although, as Dr. Mees put it, the British photographic industry failed for a time to show Ramsay's same enthusiasm, he at length secured a partnership in Wratten and Wainwright, Ltd., a small manufacturing firm in Croyden, said to be the oldest photographic plate makers in the world.

Wratten and Wainwright's products were of high grade and consequently in limited demand. Faced with a serious dividend problem, Mees devised a new method of preparing panchromatic plates, which proved the first of many successful developments that brought the firm gradually to its financial feet and won for it wide recognition in the scientific world.

Accounts of Mees' work in photographic science came to George Eastman, who at that time was about to establish a department for scientific research at Kodak Park. He arranged for an interview with Dr. Mees, at which, the latter claims, Mr. Eastman had a good deal to say about American football. In 1912 Dr. Mees was offered the position of head of the proposed laboratory, and accepted on the condition that Mr. Eastman buy Wratten and Wainwright.

At Rochester Dr. Mees commenced intensive work in fundamental photographic research. One of the definite policies of the laboratory called for the publication of the results of scientific work, with Mr. Eastman as sole censor. Dr. Mees once sent a paper to him with the notation that, in the interests of science, it should be published, but that to do so meant direct assistance to the company's competitors. "Publish it," said Mr. Eastman.

Another policy provided that the department be open to every man working in it. A conference system was adopted which still operates despite the enormous subsequent increase in staff membership.

NEWS FROM THE CLASSES AND CLUBS

1875

For several years following graduation the Class had no reunion. In 1882 the class society was brought back to life under the name of Class of '75, M. I. T., officers were chosen, by-laws adopted, and the first annual dinner was held. Thomas Hibbard was made President and he has served continuously for 49 years — it will have been 50 years when this is published in the February Review. These notes are written the day after Christmas. On interviewing Bursar Ford and Dean Lobdell, they confirmed my belief that '75 is the only Institute class which has held 49 annual dinners without missing a year. The forthcoming Semi-Centennial Annual Dinner being a unique event, Bursar Ford suggested that I should ask President Compton to meet with us, saying "that is just the sort of thing he enjoys." On this urging, I called on President Compton and invited him to break bread with the Class on the evening of January 9, 1932. Referring to his engagements he said, "I would much like to celebrate with you, but I find that I am engaged for that date." I then asked, "How about the following Saturday?" Again looking over his record of engagements, he replied, "I find that I am free for January 16 and shall be very glad to join the Class of '75 in celebrating its Semi-Centennial Dinner on that evening." With the hearty approval of President Hibbard, amended notices have been sent out changing the date to January 16, 1932, so as to have the pleasure of hobnobbing informally with President Compton. That's that. The account of the first Semi-Centennial Annual Dinner of an Institute class should appear in the Class Notes of the March Review.

At the last annual meeting the President and Treasurer were empowered and instructed to make such disposition of the class securities and moneys as they might agree upon. On my suggestion, the giving of a clock to the Institute to be placed in the Burton Lounging Room of the new dormitory was unanimously approved. Owing to unexpected delays the clock was not installed over the fireplace before commencement in June as was hoped. However, it has been in place for some time to useful purpose and is being much admired. The selection and all details relating to this gift were decided on by President Hibbard and Harry Carlson '92 of Coolidge and Carlson, architects for the Institute. The four shares of American T. & T. stock which were owned by the Class have been transferred to the Institute, with the provision that the dividends thereon are to be paid to the Treasurer during the life of the Class of '75.

In 1877 was formed the partnership of Aspinwall and Lincoln, civil engineers, both of the Class of '75. Aspinwall died in 1918 and Lincoln in 1929, but the firm of Aspinwall and Lincoln, 46 Cornhill, Boston, continues on, a notable record. William S. Crocker, who has long been associated with the firm, is head and front of the business, which he tells me is holding its own encouragingly. Near the end of 1931, he made the final payment to the Lincoln estate and he asked my opinion whether or not I would advise him to continue doing business under the name of the original firm. My reply was "yes" most emphatically.

My Christmas card from Prentiss and Mrs. Prentiss was mailed in Florida. It is a pleasing picture of the lawn and doorway of their Holyoke home, a reminder of a crowd of cheery memories. Until early April their address will be Wilbur-by-the-Sea, Florida. I am hoping that the winter will not be as unkind to them as it was in 1931.

Recently Hibbard and Mrs. Hibbard went to Stamford, Conn., for an over Sunday visit with their son Henry '25 and his wife. Mrs. Hibbard returned to Milton alone, while Tom made a detour to New Haven to call on Pierce. There was a hearty welcome, for Pierce is always glad to see a classmate. Pierce was host at luncheon at Hotel Taft for a talk-fest on old times. After luncheon it was raining hard and Tom sent Pierce home in a taxi.

Bush and Mrs. Bush are in Orlando, Fla., for the winter, and they plan to continue their residence in St. Louis, and return in the early spring via Washington. This I was told by his son, William H. Bush, who is in the office of the supervising architect, Treasury Department, Washington, a friend in need to me. I am fortunate in the people with whom I have become acquainted through M. I. T. ties.

On my home-coming to Langdrum Lane in the fall, a family had moved into the house opposite. Learning that he is an engineer, a writer, connected with the Government, I decided to make his acquaintance. Several attempts to find the family at home were of no avail. As a last resort I left my name and telephone number with the maid. This brought a telephone invitation to call, which has proven happily. Axel H. Oxholm, director of the National Committee on Wood Utilization of the U. S. Chamber of Commerce, is good to know. On mentioning my college, Mrs. Oxholm remarked, "President and Mrs. Karl Compton are our esteemed friends, and do you know Karl's brothers? They are an exceptionally interesting family." Mr. Oxholm paid tribute to the Institute Alumni, from his experience with them, for their high standing for getting results. Once the ice was broken, the acquaintance was mutually agreeable. In speaking to President Compton of the Oxholms, he replied in kind, remarking that Mr. Oxholm is a foremost authority on wood products.

In Vancouver, British Columbia, I met a doctor who saw service in France in the World War. On my casually asking him if by any chance he had met my classmate, Sam Mixter, he grabbed me by the hand warmly, saying, "I knew him well. A great surgeon, an all-round, splendid, fine gentleman. He was the most likable, cheerful doctor in war service. You have my congratulations on being his classmate." And this was followed by social amenities which contributed to the pleasure of my stay. Another interesting happening on my last trip to the Pacific Coast was in a dining car crossing Montana. I was at breakfast alone at a table for two when a man asked if I had any objection to his sitting opposite me. On my assenting, he took the vacant chair. After exchanging the usual commonplaces he remarked, "I take it that you are a New Englander?" "You are right," I replied, "and my guess is that you are a Montanan?" "You have hit the nail true," he said, "I have been in business in Missoula over 30 years." To this I inquired, "It is likely that you knew Charles Goodale?" "No," he replied, "I never happened to have met 'Uncle Charley,' as he was familiarly called, I am sorry to own, for he was the best loved man in Montana. Particularly in Butte and Great Falls, where he was best known, his death is a sad loss."

Goodale and Mixter never failed to show up for all Institute and class get-togethers whenever possible, Goodale making a special trip across the continent to report "present." Such tributes recall their delightful fellowship. — HENRY L. J. WARREN, *Secretary*, 4700 Langdrum Lane, Chevy Chase, Md.

1877

The following clipping from the Newport (R. I.) *Herald* of November 6, 1931, will be of interest to the Class of '77. "An interesting and quite touching story has come to light through the death of William H. Lawton. It appears that Mr. Lawton was a great admirer in his quiet way of George T. Seabury, formerly of this city, son of the late Hon. T. Mumford Seabury, who now holds the very important place of Secretary of the American Society of Civil Engineers. Mr. Seabury got his first ideas of engineering as a helper of Mr. Lawton, this before Mr. Seabury went to M. I. T. Later Mr. Lawton was Mr. Seabury's adviser and it is believed that it is to some extent due to Mr. Lawton that he gained his present high place.

"Recently Mr. Lawton gave Mr. Seabury, as a reminder of other days, his Technology class pin dated, it is understood, 1878. The idea was that Mr. Seabury should have his own class date put on the pin and wear it. Mr. Seabury is now arranging to do this."

1877 Continued

A letter received recently from George W. Kittredge gives a very interesting account of a visit to the ranch of C. S. Bachelder. Kittredge is visiting his son-in-law and daughter at Pataloma, Calif. Bachelder's ranch of about 500 acres is finely situated at the head of the Napa valley about 25 miles from Pataloma. Kittredge could not recall anything about Bachelder that was familiar. Bachelder was born in Eagleville, now Versailles, Conn., February 18, 1857, and was 19 years old when graduated. Two days after he left for the West. He spent two years in Colorado, most of the time in the saddle. His father located in Napa and established a cotton and woolen mill and became interested in beet sugar production. Bachelder made practical use of his chemistry in treatment of oils and sugar. Later, for ten years, he was with the Pacific Bank of San Francisco with specific interest in the gas works in which the bank people were interested.

For a year he was with a lumber company, and then was in charge of the research laboratory for the Spreckles Beet Sugar Company. At one time he had 48 men under him in laboratory work. He is married, has three children living, two boys and a girl, and one girl died about a month ago. His house with all his accumulated records, notebooks, and personal valuables was burned last May. He said he would like to attend some of the class reunions but doubted if he would be able to for some time. His address is Combsville, Napa, Calif. He certainly would appreciate letters from his classmates. — BELVIN T. WILLISTON, *Secretary*, 3 Monmouth Street, Somerville, Mass.

1887

Up to the time of this writing only one man of the Class has been heard from, that one being our ever-popular Class Treasurer, George Otis Draper. At last accounts George was on his seventh transcontinental motor trip, and was stopping at San Pedro, Calif. He is contemplating making a trip a little later to Morocco, Monte Carlo, and Paris, getting back to Boston in time for the Forty-Fifth Reunion of the Class in June. In the meantime we hope he will keep his classmates advised from time to time as to the interesting news of the tour, and wish him a safe return to the U. S. A.

Anyone know the correct address of the following from whom mail has been returned: Granville H. Parks, 50 Randolph Place, N. W., Washington, D. C.? — EDWARD G. THOMAS, *Secretary*, 1940 Calumet Avenue, Toledo, Ohio. NATHANIEL T. VERY, *Assistant Secretary*, 66 Orne Street, Salem, Mass.

1889

The Secretary has learned of the death of James W. Cartwright from *angina pectoris* and acute indigestion on September 29 at his home at Sunset Hill, Hampton, Conn. Since the death of Mrs. Cartwright, six months earlier, he had been in apparently good health, but had probably been weakened by the shock and a previous attack of acute indigestion.

Hart's book, "The Disaster of Darien," published by Houghton, Mifflin Company, has been added to the bibliography of '89. It is a very interesting and clearly written account of the history of the ill-fated Scotch Settlement at Darien and is supported by copious and valuable extracts from the English, Scotch, and Spanish chronicles of the time. His latest book is "The Siege of Havana."

Juddy Wales has made a fine recovery from his recent tedious and painful operation, which he had the power to make light of during his enforced inactivity by composing a collection of humorous poems on the subject. — From the illustrations in the Portland Evening *News*, we learn that William H. Dow of Portland is the third member of his family in direct line to be elected to the Maine Legislature.

The Somerville *Journal* of November 6 has the following: — "In the Broadway Winter Hill Congregational Church last Friday noon, Miss Mary Lillian Palmer, daughter of Mr. and Mrs. Forest C. Palmer of 93 Central Street, was united in marriage to Charles Newton Borden, of Fall River. Rev. K. K. Haddaway performed the marriage ceremony, only the immediate relatives being present.

"A reception followed to the immediate relatives at Hotel Commander in Cambridge, following which the newly married couple left for their wedding trip in the Adirondacks. They will make their home, upon their return, at 511 Rock Street, Fall River.

"The bride is a graduate of Simmons College and the bridegroom, who is a graduate of the Massachusetts Institute of Technology, is a retired manufacturer. He is a member of the Quequehan Club in Fall River, also the Technology Club of that city and New York, and the Country Club. He is a director of the Fall River Manufacturers' Mutual Insurance Co., and the Fall River National Bank."

For over 25 years, Hollis French, and his late partner, Allen Hubbard, were retained as consulting engineers by Yale University and with very few exceptions they designed all the heating, ventilating, electric, plumbing, elevator, and kitchen installations in the various buildings erected by the University in its great building program. These buildings are profusely illustrated in the *Yale Alumni Weekly* of July 31.

The *Military Engineer* in a recent number contains an article by Charles H. Deetz on "The Genesis of Geographic Names" which contains much interesting material which is new to the Secretary, at least. Deetz entered the U. S. Coast and Geodetic Survey in 1889 and served at first in the field work of triangulation, topography, and hydrography on the Atlantic and Gulf coasts; in later years as cartographic engineer in the office at Washington, D. C., in the preparation of nautical charts. He is author of several treatises on map projections. — Anyone know the correct address of the following from whom mail has been returned: Frank A. Mower, 34a Essex Street, Lynn, Mass.? — WALTER H. KILHAM, *Secretary*, 9 Park Street, Boston, Mass.

1891

At the meeting of the Alumni Council on November 30 our Class was represented by all three delegates — Charlie Aiken, Arthur Hatch, and Gorham Dana. Charlie was honored by being called upon for the salad oration and amused the members greatly by his anecdotes of Australia. At this meeting the Council unanimously accepted the amended report of the Committee on Reorganization of the Association, which called for a change in electing term members of the Corporation and certain changes in membership whereby all former students are eligible for full membership and former war time students are eligible for associate membership.

A letter from Jim Swan to Barney reads as follows: "My work is interesting, most of the time in New York, with one day every week or ten days at the shipyard in Camden and occasionally to Washington. The last time I was there, I had a very pleasant half-hour call on Charley Adams. He was one of the directors of Herreshoff's when I was manager. He is a fine man, as well as an able executive." Another letter tells of his recent auto trip to Canada. He also writes — "Lately I have been writing a short history of the Society of Naval Architects and Marine Engineers — a job which was wished on me by its President, Howland Gardner '94. That is now finished and I may turn again to editorial writing."

Mrs. Hathaway writes that Herbert passed away October 23 and was buried in the family burying ground at Assonet, Mass., October 26. According to the questionnaire which Hathaway sent in some time ago, he was employed for many years as a chemist with the Solvay Process Company, but recently retired.

Blair writes that he could not get on to our Reunion as his Fortieth at Yale occurred at about the same time and could not get away for both.

Shattuck writes that he is now at Beverly Hills, Calif. "Each year for some time Mrs. Shattuck and I have planned upon driving back East, but something has always prevented us from doing so. I had really hoped and almost expected to attend the Fortieth Anniversary of '91, but it became necessary for me to remain here and look after some matters that were rather important to me. I hope that Mrs. Palmer is very well and that she and her niece had a pleasant summer in Europe. On account of personal affairs I had to come up here from the India district last May, and I have been back there but a few times since then. I am very fond of the desert and hope to be able to spend some time there again this winter. I like to get away from the modern, crazy rush of people and things and play hermit for a time."

Miss Barbara H. Cole, daughter of Mr. and Mrs. Harrison I. Cole, was married to Mr. James Briggs West on November 27, 1931, in the old South Union Church, South Weymouth, Mass.

1891 Continued

The Class Book afforded another excuse for a picnic visit to Barney. Aiken, Garrison, Dana, Hatch, and Forbes went this time. The committee reports progress and the page proofs look fine. Perhaps you will get your copy before you read this. A round robin letter was written to Pinto and also a letter was sent to Robert Ball in Cambridge, England.

Anyone know the correct address of the following from whom mail has been returned: William C. Richardson, 960 Woodbury Rd., Pasadena, Calif.? — HENRY A. FISKE, *Secretary*, Grinnell Company, Inc., 260 West Exchange Street, Providence, R. I. BARNARD CAPEN, *Assistant Secretary*, The Early Convalescent Home, Cohasset, Mass.

1893

Mr. and Mrs. Henry Morss made a trip to Italy in the fall, returning for Thanksgiving Day with their family. Their Boston home is at 24 Charlesgate East. — Mrs. Edward Page returned in September from China, where she had been visiting her son, Edward Page, Jr., who is vice-consul at Harbin, Manchuria. — Charles Taintor is at Roll, Ariz., for the winter. — Cadwallader Washburn, who is probably the most widely traveled man of the class, is at Mallorca, Balearic Islands.

As to daughters, Frederick Dillon of Fitchburg announced, in September, the engagement of his daughter, Miss Margaret Morse Dillon, to Stanley Boutelle Fessenden of Townsend. — Mr. and Mrs. Harry Hill Thorndike in December announced the engagement of their daughter Winifred to T. Truxton Hare, Jr., of Philadelphia. — Sam Waldron's daughter, June, is President of the Junior Class at Wheaton.

Charles D. Demond, still in California, has moved from Colton to Redlands; Prof. Erwin Kennison's new address is 32 Spruce Street, Watertown, Mass.; George L. Mirick has moved from Cambridge to Stoneham, Mass.; and John Solomon is now living at the Hotel Dauphin, New York City.

As we approach our Fortieth Anniversary, we begin to hear of the retirement from business or the relinquishment of their more active duties of members of the Class. This month such news comes in of Arthur A. Buck and Harley W. Morrill.

For more than 30 years Buck has been connected with the patent department of the General Electric Company at Schenectady where, at the time of his recent retirement, he was Patent Counsel, and is still retained as a valued adviser to the Company. In 1894 he was appointed assistant examiner, in the U. S. Patent Office, and remained in Washington five years, during which time he studied law at George Washington University, where he was graduated in 1897. Upon admittance to the bar in 1899, he joined the legal staff of the General Electric Company's Patent Department.

Harley Morrill spent the early years after leaving Technology in railroad work until 1901, when he joined the staff of the Ludlow Manufacturing Associates at Ludlow, Mass., in which company he rose to the position of agent. He had a large share in establishing for his company a jute mill at Calcutta, India, which caused him to make two business trips around the world. He has developed a taste for foreign travel which, since his retirement from active work with his company in 1930, he is able to gratify freely. His home is now at Springfield, Mass.

It is our sad duty to note the passing of two active and well-known members of the class — Sam Brockunier and Howard Sargent.

Sam Hugh Brockunier died after a brief illness on March 4, 1931, at his home in Sewickley, Pa. He and Mrs. Brockunier and their son Charles had driven to Boston on February 20 to attend the funeral of Mrs. Brockunier's mother. He took a chill on his return trip which developed into double pneumonia, so that he was seriously ill less than six days.

He was a native of Wheeling, W. Va., a great grandson of Ebenezer Zane, the founder of Wheeling. He was educated at Dickinson College, M. I. T., and the Toronto School of Mines. In the course of his profession as a mining engineer and petroleum and gas geologist he had a wide experience in this country, Central America, and Canada. He also had served in an editorial capacity with the *Engineering and Mining Journal*, and other publications. At the time of his death Brockunier was doing geological work in the new gas field in northern Pennsylvania. He is survived by his widow, Clare Reed Brockunier, and five children — Charles W. of Sewickley, Pa., Sam Hugh, Jr., of Middletown, Conn., Sawyer Reed, a senior at Yale, Elizabeth B. and Clare R. of Boston.

Howard Rankin Sargent died at Bridgeport, Conn., December 8, 1931, following an operation for appendicitis. He was progressing favorably when embolism developed. With the exception of time spent abroad on a special assignment to the British Thomson-Houston Company, studying foreign methods of wiring, Sargent spent his whole life, after leaving Technology, in the service of the General Electric Company at Lynn, Schenectady, and from 1920, at Bridgeport where, at the time of his death, he was engineer of the company's merchandise department. Sargent achieved a deserved reputation in the electrical field. Many important electrical developments and inventions covering a large range of electrical devices stand to his credit. He was active in professional organizations, such as the National Electric Manufacturer's Association, the National Electric Light Association, the American Institute of Electrical Engineers, and the National Fire Protection Association, and he served on many committees engaged on engineering and standardization work. His interests, however, were not confined to engineering and while living in Schenectady, he served as President of the Common Council, as an Alderman and also President of the local Automobile Club. He was a man genuinely liked by his classmates and all with whom he came in contact. Those who attended the Class Dinner at Marblehead Neck during the 1930 Technology Reunion well remember Sargent's last meeting with the Class. Sargent was born January 21, 1871, at Newton; and lived as a boy at Newburyport, Mass., where he attended high school with others who, with him, entered Technology with the Class of '93. He was married in 1898 to Miss Emily E. Furman who, with a daughter, Elizabeth Morse, survives him.

Anyone know the correct addresses of the following from whom mail has been returned: Arthur M. Burtt, 6061 Hollywood Blvd., Los Angeles, Calif.; Nathan P. Cutler, Jr., 3 Arlington Pl., Haverhill, Mass.; Charles H. Johnson, c/o Engr. in Chief, Port-au-Prince, Haiti, c/o Postmaster, N. Y.? — FREDERIC H. FAY, *Secretary*, 44 School Street, Boston, Mass. GEORGE B. GLIDDEN, *Assistant Secretary*, P. O. Box 1604, Boston, Mass.

1894

The January issue of the *American Magazine* contains an article on our own Henry E. Warren in its division devoted to Interesting People. Anyone familiar with Henry or with the highly constructive work he has done in the years since we left Technology with our diplomas tucked under our arms will agree that he deserves a position in this category. The article does not tell all it might about Warren, but that would be a long story. As the daddy of the modern electric clock, his name is well known all over the country, but the many hours of careful and thorough study which made possible the great developments which have come from his work will never be adequately weighed by the general public. Like most great men, there is a reticence and shyness about Warren, and an innate dislike of blowing his own horn. We are glad he has been rediscovered by the *American Magazine* and take the opportunity to "point with pride" to him, as reporters are prone to say, as one of the now numerous members of the Class who can qualify not merely as interesting people, but as most useful members of the engineering profession or as first-rank executives.

In my last communication, I failed to mention attending the meeting of the American Public Health Association in Montreal, where I had the pleasure of participating in the sessions of the Division of Foods and Nutrition. The Chairman of this Division was Horatio N. Parker, who for several years has watched over the health of Jacksonville, Fla. The success of meetings of sections in a large professional society is largely dependent on the labor and skill of the chairman. Parker not only gave us a most interesting series of meetings but presided over them with such skill, sagacity, and effectiveness that all in attendance were high in their praise, and gave him a unanimous and cordial vote of thanks at its final session. It is always a pleasure to the Secretary to make these contacts with Parker, and we go back in our reminiscences to freshman days at Technology,

1894 Continued

when we were in the same section, and generally equally impecunious. We rather brag of the days when we used to walk out over the then new Harvard Bridge with a total combined capital of seven cents, or some such amount. It is a pleasure to mention now the excellent work Parker has done in his profession, and the Class may well be proud of it and of him.

A recent letter from Ray Price tells of an 8,000-mile trip through Russia as far east as the Chinese border, and of his observations on the trend of events in the Soviet Republics. It is hoped that an account of this journey and especially of Price's interesting and well-considered views of the activities he observed and the information he acquired will appear in The Review in the near future. Anyone who is willing to think seriously on these matters of world interest cannot fail to get from his account abundant material for careful consideration. Moreover, all of us who know Price will readily understand that he is not likely to accept statements without verification or proper authority, nor to be open to the charge of exaggeration. I hope he will secure the ear of the American public through his articles.

Mrs. de Lancey is again (or was) exploring Central Europe. Not satisfied with a trip during the summer, she returned in time to accept her husband's invitation to go back on the same ship for new adventures. A postal from her, dated at Prague on October 24, tells of her impressions in that city. We simply cannot keep up with this enterprising and busy lady, but it is always a pleasure to hear from her as she flits from land to land.

Fred Leonard has recently sent in the address of Limerick, Maine. Fred has been attached to the Maine Highway Commission for some years, but it is only by luck that the Secretary gets these occasional hints as to his location. Let this be a hint to the many who are also far too uncommunicative. — SAMUEL C. PRESCOTT, *Secretary*, Room 10-405, M. I. T., Cambridge, Mass.

1895

The New York contingent of '95 held their fall luncheon on December 9, at one o'clock, at the Railroad Club of New York, 30 Church Street, New York City. The following men attended: Arthur L. Canfield, John H. Gardiner, Edward H. Huxley, John D. Moore, Franklin A. Park, Frank C. Schmitz, Gerard Swope, John J. C. Wolfe, and Leon W. Miller, a nephew of Canfield, as guest. Arthur D. Dean, Henry P. Coddington, and Thomas H. Wiggin were out of town and regretted missing this regular function.

Charles E. Birge and Ralph N. Wheeler are in Florida. Gerard H. Matthes is still located at Norfolk. Va., being engaged on river studies for the War Department. — Francis E. Faxon sent his best wishes from 5 North Cherry Street, Poughkeepsie, New York. — Frank Park, who had just returned from Europe, gave a very interesting talk on business conditions as he saw them. A number of topics of the day were discussed including the letter from Secretary Yoder. This letter was termed a "classic." The ever reliable Johnny Moore led the discussion.

The subject of having another Class Reunion was carefully considered. It was decided to postpone such an event on account of the present unstable business conditions.

David B. Weston of Course V has again turned his steps towards South America. His address is Bobures, Estada Zulia, Venezuela.

Mr. and Mrs. John J. Colvin Wolfe, Class of '95, of Westerleigh, Staten Island, New York, issued invitations for the marriage of their daughter Miss Cecilia Moise Wolfe to Mr. Charles Paul Le Mieux of St. Regis Falls, N. Y., held on the afternoon of December 19, at St. Peter's Church, New Brighton, Staten Island.

Anyone know the correct address of the following from whom mail has been returned: Francis C. Green, Aurora, Ill.? — LUTHER K. YODER, *Secretary*, Chandler Machine Company, Ayer, Mass. JOHN H. GARDINER, *Assistant Secretary*, Graybar Electric Company, Graybar Building, New York.

1896

Before leaving for his new job in Russia the last week of November Eberhard A. Lindenlaub, the son of our old classmate Armin Lindenlaub, came on to New York and got in touch with Charlie Lawrence. They had a real get-together talking over things that Charlie and Armin did as students. This New York trip resulted in further information for the Secretary to the effect that Armin's brother Eric, who is a graduate chemist of a German university, is employed in New York and living in the Bronx.

Charles W. Tucker finds it very difficult to discontinue his financial support of Technology through the regular lines of tuition, although it looks as if he was getting to the point where he would be unable to find any excuse for doing so much longer, unless he decides to come back to school himself. The last member of his family in the person of his daughter Helen is now at Technology as a graduate student for a doctor's degree in chemistry.

Professor R. W. Lodge, who has made his home on an orange ranch in Redlands, Calif., since his retirement from Technology a number of years ago, serves as a means of keeping track of our classmate C. J. Barnes, who was with us only a year or two as a student in the Chemical Department. Barnes has also lived in Redlands for many years and he and Mrs. Barnes perpetuate the old New England custom of having a real party on Thanksgiving Day. This year they were hosts at Bryn Mawr to 28 members of their family, who were gathered from nearby points in Southern California. This family Thanksgiving party has been an annual event for more than 15 years.

On December 10, along late that Sunday evening, the telephone bell of the Secretary rang at his home, and much to his surprise he found Vernie Peirce was in Boston and was on the other end of the line. He had lost his mother, who had continued to live with Vernie's unmarried sister in the old home on West Newton Street. Vernie reported that his public roads job in Washington kept him busy and that he was away from the Capitol about half the time traveling over various parts of the country, presumably on road inspection, although he did not specify whether he did it as a pedestrian, or by hitch-hiking, or in a royal manner in his limousine with a chauffeur.

The eagle eye of Sam Wise spotted an article on the Reverend Welles Mortimer Partridge in the Boston Sunday *Globe* of December 6. This article was headed with a cut of Partridge standing beside his automobile, which he admitted was of ancient though honorable lineage and about 11 years old. His luggage was strapped on the running board, his dog Spot was beside him, he had in his hand a blackthorn stick presented by Mayor Curley and on his head was a derby hat. Partridge's object is to make a tour of the Pacific Coast, which he has not seen since he returned from his missionary work in Alaska 30 years ago. He plans to camp where night overtakes him, and expects to cover eight thousand or nine thousand miles before his return. He proposes to do missionary work en route and hopes that the outdoor life with a little bit of roughing it will be of marked benefit to his health, which has not been of the best during the past year.

Partridge has been out of the limelight as far as class news is concerned for some time, the last heard of him being the report of the fire in his car in New Haven two years ago, at which time he was considerably burned in rescuing the little dog Spot. Incidentally, this is the same car.

The latest word regarding Clark Holbrook is that he staged a return engagement in November and became a grandpa for the second time, with the result that he now has two granddaughters, and has put in an application for a grandson.

Eddie Mansfield gave his second talk to the M. I. T. electrical students on November 19. His two talks covered opportunities available in the electrical field, the benefits which accompanied employment with companies such as the Boston Edison Company, with which Eddie is associated, and outlined the qualifications necessary for a man to make himself of the greatest value in the field of public utilities.

The Secretary regrets to report the death of Miss Rebecca Kite, which occurred on June 9, 1931. She was a special student in biology at various times from 1895 to 1907 but she chose to consider herself a member of the Class of '96. She also attended teacher's classes in botany and zoölogy at Harvard. She was born July 29, 1859, in Philadelphia and from 1899 until September 1, 1926, when she retired, she taught biology in the Jamaica Plain High School, formerly the Roxbury High School. After retirement she traveled abroad, and then settled in Attleboro, where she died. The burial was in Philadelphia. Miss Kite was interested in

1896 Continued

public affairs in a quiet way, being a member of the Women's Municipal League, the Red Cross, Boston Teachers' Club, High School Assistants' Club, Association of Technology Women, Boston Teachers' Biology Club, Harvard Teachers' Association, and a fellow of the Association for the Advancement of Science. — CHARLES E. LOCKE, *Secretary*, Room 8–109, M. I. T., Cambridge, Mass. JOHN A. ROCKWELL, *Assistant Secretary*, 24 Garden Street, Cambridge, Mass.

1899

W. E. Parker of the Coast and Geodetic Survey has been recuperating from an illness at Norfolk, Va. He writes that he is finishing the records of his field survey of last summer and then he is taking a vacation, probably in the south. He has a home at 23 Baltimore Street, Kensington, Md., through which mail reaches him eventually. He will be glad to hear from any or all of '99. Your Secretary modestly invites the same attention. He, too, will be glad to hear from any or all of you. We are members of the Nine Issue Club and news has been scant and none too cheerful.

It is with regret that I must announce the death of Newton Davis Benson at Providence, R. I., November 18.

Anyone know the correct address of the following from whom mail has been returned: Harry G. Johnson, 15 Metacomet Road, Waban, Mass.? — W. MALCOLM CORSE, *Secretary*, 810-18th Street, N. W., Washington, D. C. ARTHUR H. BROWN, *Assistant Secretary*, 53 State Street, Boston, Mass.

1901

There seems to be some sort of an association between conventional holidays and the inditing — this is not the same as indicting — of the Class Notes. Tomorrow will be Christmas Day and so this message goes out to you all, bearing my best wishes for the Christmastide and my earnest hopes that the New Year will be an improvement on the one that we close without regret in a few days. The one bright spot in 1931 was the Class Reunion and we haven't got that to look forward to in 1932. However, you will all be so busy building homes during the coming year that you probably would not find time to get away for the Reunion.

Having been myself hit by the prevailing depression, to say nothing of the effect on my spirits of the several panaceas from Washington, I am not in a position to send out to my classmates the valuable and artistic testimonials of my esteem and regard that have characterized other Christmases in the past. I made out my list, however, in the hope that I should not find myself in the gloomy position of Teddy Taft who sent in on his Data Sheet recently "absolutely no change." That's me too, Teddy, and I haven't had to make a cut with any one.

Mat Cushing who has a ranch in Saratoga, Wyo., writes that he is cattle raising, which I presume in these lawful times is not the same as cattle lifting, though the directional trend is identical.

Phil Moore, by the way, is another ranch owner and cattle raiser; this one more outlet of his desire for privacy.

In the welter of unhappiness that surrounds us it is nice to hear from Lenny Florsheim and learn that his present occupation in detail is "finance." That is about all the detail that I could offer on so intricate a subject, but it does seem to me as if Lenny might have done a little better. It may be, of course, a delicate way of implying that he has joined the ranks of the unemployed, in which case I presume he is studying plans of the home he is to build. Somehow I always thought Lenny had a home but I presume that that has no bearing on the wave of prosperity that is to sweep over us when we carry out the mandate from Washington. As the poet so truly said, "What is home without another."

I seem to have a quiver full of Chicago news and I pause to pay my tribute to that leal and staunch classmate, De Berard, who, like the honest fellow that he is, sends me in some real news. In the first place, Bill lives out in Wilmette on the outskirts of Chicago, which, as it has a population of 15 thousand, puts it on the index with Phil Moore. The town is soon to build a 500-thousand-dollar water-plant which is being designed by Langdon Pearse and his associates, though why water in a community flowing with beer, blood, booze, benevolence. (see under "B" in Webster's Unabridged for additional details)? Bill is associate editor of the *Engineering News Record* and is a village trustee of the town which is sufficiently affluent to waste all that money on water. He reports a recent return, at the time that I received his letter, from a vacation in the Rocky Mountains, where he has a place boasting of a splendid isolation to which he has repaired for the past 30 years. Quoting exactly, he says that there he can get away from "people, societies, conventions, committees, God, and engineers." I think Phil Moore may be interested in this if he could only persuade Bill to go somewhere else.

Moving eastward to New York City, another Bill, Farnham this time, reports the completion of 30 "very pleasant" years continuous service with the American Telephone and Telegraph Company. At present he is the local traffic engineer in the department of operation and engineering. When he wrote me, he had just returned from a short European trip which had covered the British Isles, Switzerland, and France. *Trente ans après.*

I have just run through 19 Data Sheets which contain the bright, chatty, and voluble exposition of personal activities which are comprehended between "same as before" on one hand, and "no change" on the other. Only Beckwith of Garrison, N. Y., known even in his undergraduate days for a gentle and urbane courtesy that distinguished him from his fellows, adds the touch of elegance in the outburst "same as already reported." Our Miltons are certainly mute, even though they are not inglorious.

Ralph Stearns, who shook the dust of Boston from his feet some years ago and is now living in Bronxville near Arthur Hayden, writes me that he is with Colonel F. W. Scheiden (turn over) helm and that they are consulting engineers on hydroelectric development work for the American Gas and Electric Company and similar interests. In town, Ralph is to be found at 50 Church Street.

Well, I hear the jingle of Santa Claus' sleigh bells arriving to bring me a late season crop of unpaid bills, requests for contributions to a variety of worthy charities — personally I fall in the unworthy group — and requests from the Federal government to explain how I could possibly have spent $7.63 on a professional trip to Europe. These will wile away the tedium of the hours till midnight, and I leave you all in my thought engaged in similar pleasing pastimes, though you will not learn of my fellow feeling for some months to come. And thus I close, as did Pepys, without specifying whose, "and so to bed."

Anyone know the correct addresses of the following from whom mail has been returned: Eben Chapman, Penn. Steel Co., Steelton, Pa.; Seisuke S. Enouye, 30 Dojima, Osaka, Japan; Walter I. Martin, Barrington, Ill.? — ALLAN W. ROWE, *Secretary*, 4 Newbury Street, Boston, Mass.

1905

Another Adams is too busy and another Mrs. Adams is good enough to give us a story, this time Mrs. C. Robert, who writes: "Your letter has remained unanswered a month owing to Mr. Adams' inability to find time to drop you a line. The enclosed clipping, written by an editor on a recent fishing trip, gives you an idea of Mr. Adams' activities. The winters are severe here and the road will be closed by snow early in the fall, which necessitates rapid progress during the summer months. It is a hard rock job running 40,000 yds. to the mile with some cuts 90 ft. on the high side.

"Mr. Adams is enjoying a little diversion today in Reno. As the fight did not appeal to me, I remained at home to catch up on some of my neglected correspondence and sent our young lady daughter in my place.

"Kindly change our address to Downieville, Calif. You would enjoy seeing this ghost town with its narrow streets, iron shuttered windows and 1850 A.D. stores and hotels. It is 32 miles to the nearest railroad and that only a logging spur track. The presence of the automobiles and the numerous tourists en route east over the Yuba Pass mark the only advancement or change in 75 years. Gold is still to be found in paying quantities. Trout fishing is excellent and the 3,500-foot elevation adds zest to the adventure. Sounds like a summer boarding place ad, doesn't it? I will let Mr. Adams write the next." The next has not arrived. Still too busy. The clipping gave an interesting description of Bob's job but is too long for reproduction. Thank you, Mrs. Adams.

1905 Continued

Your Secretary was in Boston early in December and dropped in upon Bob Lord at his home in North Woburn where he has been living for a year or so. Bob seems pretty well recovered from his illness of last spring, in fact he hasn't looked so well for a long time. For years he has stuck closely to his job. Now he has a movie outfit and exhibits his product with justifiable pride. But Elm Street, North Woburn, is hard to find in the dark. — At the Institute we made calls, altogether too short, upon Henry Keith and Doc Lewis. Henry is still specializing in launching huge ships. When he can't launch one himself, he goes off to see somebody else put one over. Only recently he was an observer at the launching of the "Manhattan," U. S. Lines, christened by Mrs. Theodore Roosevelt, Sr., at Camden, N. J. — We buzzed Doc in his private laboratory and doubtless prevented his making a few more improvements in his gasoline cracking process.

If we only saw the Boston papers regularly! We happened on the *Transcript* of December 16 and a story. The former chairman of the State Art Commission petitioned the Senate for the appointment of a special legislative commission to construct a triumphal arch as the Massachusetts War Memorial. The point is that Sid Strickland designed the arch, planned to be erected on the Common, facing Charles Street, on the center line of Commonwealth Avenue extended across the Public Garden. The arch is 90 feet high, 66 feet wide and 28 feet in depth, of Massachusetts light granite, with a figure of Victory surmounting the main structure. A memorial chamber of marble, with bronze tablets, is located over the arch. The total cost is estimated at $500,000. This design was the first concrete suggestion received by the War Memorial Commission appointed during the administration of former Governor Frank G. Allen.

John Glidden wrote in September: "I wish I knew when I shall be likely to visit home again. Just now the chances seem to be especially slim. But when I am there, I shall make some attempt to see you as when I go to Boston from New York. I was in New York from April to December in 1929, with three or four trips to Boston. I saw only Frank Elliott and Carhart of '05 and Bill Motter. I have met Bill in Chile and once on board ship in Callao harbor. I heard of Senger's being in Lima, but too late. I called at his hotel some few hours after he had checked out to return to the States. It seems extraordinary that I did not meet him in the relatively small orbit in which gringos circulate in the little town of Lima.

"Our tunnel is now at 11,400 feet and we look to finish it at 30,200 feet in something like two and a half years more, slightly less if we have very good luck. Last July we made 847 feet which, as far as I know, is a record for anything of the kind south of Mexico. One thing we are extremely proud of is the absence of a fatal accident and I am inclined to think that that is a world record for the distance and the size of the tunnel."

John's present address is Alcanflores 229, Miraflores, Lima, Peru. — ROSWELL DAVIS, *Secretary*, Wesleyan University, Middletown, Conn. SIDNEY T. STRICKLAND, *Assistant Secretary*, 20 Newbury Street, Boston, Mass.

1907

Plans have begun to take definite shape for our Twenty-Fifth Reunion! At an informal meeting called by the Secretary in Boston on December 16, at which were present Alexander Macomber, Harold Wonson, Sam Coupal, Don Robbins, "Kelly" Richards, Oscar Starkweather, and the Secretary, it was decided to hold the reunion from the afternoon of Friday, June 17, 1932, to the afternoon of Sunday, June 19. As to location, we chose the Oyster Harbors Club at Osterville, Mass. This is on Cape Cod, in the same town as that in which we assembled in 1927, but in a different club. Some of our classmates have been guests at Oyster Harbors Club and they unanimously report that it is first class and delightful in every respect.

The club has its own 18-hole sporty golf course, bathing beach, tennis courts, riding stables, and the typical Cape Cod surroundings make it ideal for recreation of many kinds. The reunion will be a "stag" affair. We will send announcements of this event to all members of the Class soon, and will keep everyone informed on further plans at intervals between now and next June. We shall plan to keep the expense as low as possible consistent with covering all items of the two days completely and in the high-grade manner which the Class expects. Exactly what this will be cannot be stated as yet.

On December 15 Albert Bancroft and his wife gave a tea at which they announced the engagement of their daughter, Marjorie, to Vincent C. Stanley, Jr., of West Newton, Mass. Miss Bancroft has attended the Beaver Country Day School and the Lee School and is now studying at the New England Conservatory of Music in Boston.

Again we are indebted to Professor Locke for the following information regarding L. C. Hampton: "He is still in Nicaragua, but had been down to Panama on a business trip, taking his wife along. They went down by boat, which took three days, and returned by airplane in five hours. While in Panama they had some very heavy rains, including that one which caused the slides to block the Panama Canal for the better part of a week, so that at one time 79 vessels were waiting their turn to go through. One day seven inches of rain fell in five hours. They passed through the canal on a steamer and spent the night in Colon, seeing the sun set in the Atlantic Ocean. They then returned across the Isthmus by airplane, following the line of the Canal. This return took 25 minutes as compared to eight hours by boat. The dry season has now started in that country and for six months no rain will fall. Incidentally, he saw the sun rise in the Pacific Ocean over Panama.

"While he is in Central America his address will be c/o Mr. J. Vassalli, Corinto, Nicaragua, but at all times anything sent to his permanent address, 2331 Sixth Avenue, Los Angeles, Calif., will always reach him. He gave a lot of interesting data about Nicaragua, the U. S. Marines, bandits, and so on, and added that the book written by H. R. Denny entitled 'Dollars for Bullets' gives a very true picture of the situation down there."

Lawrence Allen writes: "I would be very happy if you would insert the fact in the next issue of The Technology Review that, in the words of Mark Twain, 'the report of my death has been greatly exaggerated.' It was very good of you to notify my classmates last winter of my illness. As a matter of fact, for a little while I was about eight down and nine to go, but I am back where I can play 36 and ask for more, and I feel that there may be a few more kicks left in the old man yet. I met an old friend the other day who seemed rather surprised to see me and I am anxious to report to all my friends and classmates that I am alive and on the job — and expect to continue to be."

Anyone know the correct address of the following from whom mail has been returned: Raymond Ware, Heights Court Rd., Ithaca, N. Y.? — BRYANT NICHOLS, *Secretary*, 19 Rowe Street, Auburndale, Mass. HAROLD S. WONSON, *Assistant Secretary*, Commonwealth Shoe and Leather Company, Whitman, Mass.

1909

We had to skip last month because of lack of news, and here we are nearly up to the dead line this month and still no Class news for The Review. Some of you fellows must be doing something which would be of interest to the rest of the Class. We should so much like to hear from you. Please write to us. — CHARLES R. MAIN, *Secretary*, 201 Devonshire Street, Boston, Mass. PAUL M. WISWALL, *Assistant Secretary*, General Foods Corporation, 250 Park Avenue, New York, N. Y. MAURICE R. SCHARFF, *Assistant Secretary*, First National Bank Building, Pittsburgh, Pa.

1910

Your Secretary was laid up with an attack of the flu a month ago and missed the January issue entirely. There was not much material on hand at the time, anyway, and it is all here. Clippings about our famous classmate, Stuart Chase, keep drifting in, and one cannot print all of them. The Evanston (Ill.) *Index* had an article about an address Stuart gave. It says in part: "The Sisterhood of North Shore Congregation Israel, Lincoln and Vernon Avenues, Glencoe, presents Stuart Chase at its second lecture on its forum series on 'The Nemesis of American Business.' Stuart Chase is one of the outstanding economists in the country. His keen analysis of industrial conditions so eloquently put forth in his book 'Prosperity — Fact or Myth' has stamped him as an authority in the field. He has by experience a technical training, emi-

1910 Continued

nently qualified to discuss problems dealing with the national and international industrial business conditions."

Skeet Everett writes from Watertown, Mass.: "If I was still in the mining game I might have something of interest to write, and then of course I might not, but I am sure there is little romance in industry. The only fruit of my efforts of the last 14 years in the Rubber Industry, which might be of interest to an outsider, was some work I did about three years ago for Professor Drinker in developing the proper collar for the now famous Drinker and Shaw Artificial Respirator. The collar was the last link in a long chain of work by Drinker and Shaw which assured the success of the machine. The solution of the problem was, like any other, a question of analysis and synthesis, but the enthusiasm with which the solution was received provided considerable pleasure."

The Holyoke *Telegram* has this to say about Herbert Gott: "Herbert S. Gott, a resident of Russia for 15 years, during which time he was given first-hand opportunity to study the affairs of that country, will deliver an address on 'Russia Industrially,' tomorrow night before a city-wide forum for men of rank of the Holyoke industries at the Y. M. C. A. Mr. Gott was born in Gloucester and educated at M. I. T. He took up engineering and for several years was with the Metropolitan Street Railways Company. He recently returned from Russia and Esthonia, where he spent 15 years. During the World War he and his family were sent to Siberia for service among the prisoners of war and later with the Russian army. He was under fire for eight days during the Russian revolution, finally escaping with his family to Yokohama. Returning to Russia he was driven out a second time. At the close of the World War he did much work among the Russian refugees in Harbin."

Bob Dillon writes: "Your letter finds me at the Edison Electric Illuminating Company of Boston, as before, and I am glad to read the news of our Class in The Review. Since I joined this organization, another '10 man, Fred W. Osborn, has entered its employ and recently was placed in charge of the station properties of the generating department."

The death of Cedric Anderson was described in the New York *Evening Post*, and Phil Burnham sent in the following clipping: "Cedric Anderson, a postgraduate student at Columbia University, died there of a heart attack in a classroom of the School of Business today. Mr. Anderson was a practicing engineer who was studying for his master's degree. The heart attack came without warning and Mr. Anderson, after his collapse, never regained consciousness. He was dead when Dr. William K. McCastline, the University physician, arrived on the scene after a hurry call from students and instructors. Mr. Anderson, who is 42 and a married man with four children ranging in age from three to 16, left his home at Hastings-on-Hudson this morning in the best of health. He had never had heart trouble and, in fact, had never spent a sick day. The student was graduated from M. I. T. in 1910 and for 20 years was active in engineering. Last year he decided to take his master's degree in the School of Business in order to train himself as an executive."

Don Williamson writes: "Recently Stuart Chase of our Class, addressed 650 members of the Rotary Club of Chicago on the Subject 'Has America Come to the End of an Epoch?' Perhaps the best tribute I can offer as to this talk was the fact that I did not see a man leave the hall, although Stuart spoke some ten or 15 minutes over time. At this meeting of the Rotary Club of Chicago (of which I happen to be a member), Lloyd Cooley '11, who is Secretary of the Technology Club of Chicago, and myself sat at the table with Stuart. Neither Lloyd nor I had seen him since we graduated and it was a great pleasure. Another very strange coincidence was this — that right in front of us at that meeting we saw the familiar face of Charlie Belden, who was present that day as the guest of a friend. Neither Chase, Cooley, nor I had seen Belden since we graduated some 21 years ago, and we sort of had a Technology reunion right there. Charlie reports that he is operating a sheep ranch at Pitchfork, Wyo." — DUDLEY CLAPP, *Secretary*, 40 Water Street, East Cambridge, Mass.

1911

These notes are being prepared just before Christmas and if there is such a thing as mental telepathy every '11 man must realize that Dennie is wishing him heartiest seasonal greetings up here at Douglas Hill, where a cold rain is rapidly taking away a glazed inch-thick coating of snow.

Don Frazier, II, accompanied class dues by a letter stating he is taking up golf down there in Richmond, Va., in self-defense, so expert is his wife becoming, having recently won her flight in the Country Club tournament there, not to mention the putting prize from all the lady contestants. At the last convention of the Capitol District Kiwannis Clubs, Don adds, he was elected Lieutenant Governor of the Fourth District, including Delaware, Maryland, D. C., and Virginia. This, he says, will keep him busy in addition to his flourishing insurance business.

Skip Harrington, I, has once again returned East from the wilds of Cheyenne, Wyo., and is now at 208 Aspinwall Avenue, Brookline. — At the annual meeting of the Massachusetts High School Coaches' Association, December 12 in Cambridge, Charlie Linehan, I, was reëlected secretary for his fifth successive term.

The D. R. Stevens family, artistically grouped around the homestead fireplace, furnished the subject of their usual attractive Christmas card this year, and Don himself looks younger than ever with his omnipresent smile *de luxe*.

Now in addition to his independent office at 551 Fifth Avenue, New York City, Emmons Whitcomb, X, announces the opening of a new travel office in coöperation with The Travel Advisers, Chase Associates, Inc., 522 Little Building, Boston. — Erv Young, I, who for years has resided in Arlington, N. J., has, with his wife and youngster, moved to 54 Warwick Street, East Orange.

Heine Zimmerman, IX, announces that in January, 1932, after more than 17 years in Pittsburgh with the American Sheet and Tin Plate Company, he is moving to San Francisco as Assistant to the President of the Columbia Steel Company, in charge of operations. This company, he adds, is one of the subsidiaries of the United States Steel Corporation and embraces its interests in the Pacific Coast territory. Thus while changing his geographical location decidedly, he is still at home with his employers. His headquarters in Frisco will be in the Russ Building, where he hopes to welcome all '11 men who journey to the West coast.

He adds some interesting '11 gossip: "These are stringent times in Pittsburgh. Nevertheless, a few weeks ago I saw Bunny Wilson, XIV, classmate and Vice-President of the Aluminum Company of America, squandering money in a most reckless fashion. It was for a good cause, so more power to these vice-president folks, says I. . . . Had you heard that Marcus Aurelius Grossman, III, premier metallurgist of our class and former Vice-President of the Republic Research Corporation, has joined the staff of the Department of Research and Technology, United States Steel Corporation? Marcus will be located with the Illinois Steel Company in the Chicago district most of the time. We fellows who are working for the Steel Corporation are glad to have such talent within the fold, for it should relieve the pressure of competition."

Just the kind of letter that gladdens a secretary's heart, Heine, and more power to you and heartiest wishes for continued success in your work!

Anyone know the correct address of the following from whom mail has been returned: Guy W. True, 317 Chestnut St., Needham, Mass.? — ORVILLE B. DENISON, *Secretary*, Douglas Inn, Douglas Hill, Maine. JOHN A. HERLIHY, *Assistant Secretary*, 588 Riverside Avenue, Medford, Mass.

1912

A recent luncheon meeting of the New York group was attended by Clarence MacDonough, I, H. M. Priest, I, C. H. Carpenter, II, B. H. Morash, VI, and D. J. McGrath, I. Discussion mostly centered around the Twentieth Reunion which is now only a few months off. All hands expressed their hopes of being able to attend.

Clarence MacDonough was called upon to give an account of himself, as we hadn't seen him for several years. He was formerly with the Foundation Company of New York, and as engineer for that organization he was in Europe from 1927 to 1929, in charge of their construction work abroad. His duties took him to various jobs in England, France, Spain,

1912 Continued

Italy, and Greece. After his return to the United States, he went with Mason & Hanger, general contractors, as their engineer. At this writing MacDonough's principal activities are in connection with the building of the new vehicular tunnel under Boston Harbor to East Boston. His residence address is The Towers, Jackson Heights, Long Island, N. Y.

Anyone know the correct addresses of the following from whom mail has been returned: Donald E. Bent, American Utilities Co., Tucumcari, New Mexico; Ward N. Gere, 307 Second St., Liverpool, N. Y.; Charles H. Mills, 130 N. Drexel St., Indianapolis, Ind.; Kenyon von Pruyn, 270 Glen St., Glens Falls, N. Y.? — FREDERICK J. SHEPARD, JR., *Secretary*, 125 Walnut St., Watertown, Mass. DAVID J. MCGRATH, *Assistant Secretary*, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York, N. Y.

1914

Dave Gould came up to New England to visit the home folks on Thanksgiving, and being a good and obedient '14 man, called on your Secretary. It certainly seemed good to see him again and also to know that there are some classmates thoughtful enough to help out with the Class Notes. Dave has rejoined the Barrett Company and is in their research laboratory at Edgewater, N. J.

Louis Charm, who continues to wire up the City of Boston with his trick electrical circuits, reports that he recently was the successful bidder on some work being done for the City of Boston at the City Farm. He writes that the important part of the work was that he made a pleasant contact with the superintendent and was assured that proper reservation could be made for any '14 men that were looking for a place to keep warm during the winter. This begins to look comforting for a lot of us.

Dean Fales always seems to have a bright idea at the right time. For some time he has been summering in Maine. This was thought to be for pleasure only, but it now develops that he has been taking an inventory of some of the recently abandoned farms. He has worked out a plan whereby a group of these farms can be bought on an acreage basis, and that it would only take a few classmates with but just a few dollars apiece to set up a life-endowed colony. Dean has been making trips down almost every week-end during the early part of the winter. Your Secretary really thinks this looks a little better than Louis Charm's proposition. It has some drawbacks in that it is a little farther walk down to Kennebunk, Maine.

The Assistant Secretary, George Perley, reports that while attempting to see that all of New York's schools and hospitals are equipped with the world's best fire alarm and signal system, he met Dana Mayo, who was trying to see that they were all equipped with the world's best boilers. Mayo has just recently come East and is now with the Babcock and Wilcox Boiler Company, with headquarters in New York City. Like all good New Yorkers, he expects to move his family East soon and settle in the great suburb known as the state of New Jersey. Perley also reports that in his travels he met Deak Barns, who is trying to see that these same buildings are all equipped with greenhouses. Deak has joined the Lord and Burnham Company, with headquarters in the Graybar Building in New York City.

At Deak's suggestion Bob Moorhouse was stirred up. Bob is now out in Akron, Ohio, as a chemist with the Goodyear Tire and Rubber Company. His immediate chief is none other than R. P. Dinsmore, who is Chief Chemist of the Goodyear Company. Bob writes that he has settled just outside of Akron at Fairlawn, where his principal activity is keeping his three-year-old son out of difficulty. Your Secretary suspects, however, that he is not neglecting Robert Lindberg, who arrived on September 17. Bob seems a bit disappointed that the new arrival is not red-headed like his older brother and Dad. Bob also writes that Walter Keith is in Akron and has his own business. He says that he, Keith, and Dinsmore meet occasionally for a Fourteen reunion, the last time being an inspection of the U. S. S. *Akron*.

Did you remember to send in the athletic fund contribution mentioned in the last issue of The Review?

Anyone know the correct addresses of the following from whom mail has been returned: Frederick B. Barns, 155 E. 42 St., N. Y. C.; James T. Holmes, 521 N. Bedford Dr., Beverly Hills, Calif.? — HAROLD B. RICHMOND, *Secretary*, 30 Swan Road, Winchester, Mass. GEORGE K. PERLEY, *Assistant Secretary*, 21 Vista Way, Port Washington, N. Y.

1915

An aftermath of our recent class dinner in Boston is the distinction due Leslie Heath, V, of having the first class son ready for Technology. Les has a 15-year-old boy, a high school sophomore, preparing for the Institute. Unless someone rises to challenge this, it looks as though young Master Heath will win this honor in our class.

In Newark, N. J., recently I had lunch with Ed Fonseca, VI, as amusing and as attractive as ever. Has he got new stories for our next reunion! I phoned Kebe Toabe, V, in Elizabeth. He and Edmund Stearns, I, of Montclair, whom he sees occasionally, have suffered from the slump in building construction. I dropped in for a pleasant visit with St. Elmo Piza, IV, and Jim Tobey, IX. Jim has written another book, "Cancer, What Everyone Should Know About It." In this he was encouraged by H. L. Mencken. In the January, 1932, *American Mercury* and the December, 1931, *Scientific American*, Jim has had articles on cancer. But next month, we shall have a positively intriguing bit of news about Jim's literary proclivities.

Then I spent an enjoyable Sunday afternoon with Louis Zepfler, V, and his family in Jersey City. Upon my return to New York, I hope to see some of the other boys whom I missed this time. In Detroit I spent an evening with Gabe and Mrs. Hilton as happy and as hospitable as ever, reconciled to the futility of worrying over the well-known depression. In Albany I called on Norman and Mrs. Doane. He is being transferred to Chattanooga, Tenn., for the Permutit Company. His letter of some time ago follows: "An appeal for a few dollars from a hard-working class secretary can hardly be resisted. I am, therefore, enclosing my check for $2.00 to help along the good cause.

"Since I saw you and the rest of the bunch who were at the Class Reunion last June, I have been transferred from Indianapolis to Albany. I am still with the same company, only operating out of Albany. I get as far west as Syracuse, north to the St. Lawrence River, south to New York City, and east to the Connecticut River in Massachusetts.

"I have met quite a number of Technology men around Albany and Hartford, Conn., in the past few months, but as far as I can recall now, none of them were in the Class of 1915, so I cannot give you any class news. I just missed seeing Allen Abrams at a Papermakers' Convention in New York about a month ago.

"Edward Snyder, who took his M.S. in 1915, I have seen lately several times in Troy. He is with the Hudson Valley Fuel Corporation, and doesn't look a year older than when he left Technology. There are several other Tech men with this concern, which is a subsidiary of the New York Power and Light Company.

"My best regards to you. I'll be seeing you at our Twentieth in 1935!"

News comes that McCeney Werlich, X, has been transferred from Warsaw to Costa Rica as Third Secretary of the American Legation there. He surely has had some colorful and interesting stations in his diplomatic life.

Fiske R. Jones, Superintendent of the Simonds Saw Works, Fitchburg, Mass., writes as follows: "Enclosed, find two dollars for class dues. — I am really too busy with our new windowless factory to write a news letter. — I am glad to extend an invitation to the members of the class to inspect this new plant which will be opened in July." This unusual plant has been described in trade papers and in The Technology Review and is of interest to the engineering members of our Class. All those who remember the spirited activities of Phil Keeney around the old "chapel" will marvel at his change to the dignified position of head librarian at the Montana State University at Missoula, Mont. Phil went there from the library staff of the University of Michigan. This is the first word we've had of Phil in 20 years and it shows what a vast opportunity for change is open to us all. These dues letters won't last forever, so please begin to write in about yourselves or about our column.

Anyone know the correct address of the following from whom mail has been returned: Reginald F. Pollard, Box 21, Station A., Gorham, N. H.? — AZEL W. MACK, *Secretary*, 379 Marlboro Street, Boston, Mass.

1916

Shortly after leaving the Institute, John M. McDevitt became interested in the manufacture and sale of a mechanical device for repairing automobile motors. The manufacture of these devices was performed by the Dover Parts Company of Providence, R. I., and the sales were so successful that Mac soon bought one half interest in the company. Since then his company's name has been changed to Lincoln Machine Company, and the plant moved to Esten Avenue, Pawtucket. The company has branched out into a special field, designing extraordinary tools and manufacturing many devices for concerns throughout the world. Special attention is being paid to products requiring the greatest possible accuracy of measurement and detail. The Lincoln Machine Company is now becoming engaged in the production of tools for making airplane engines, and in the not too distant future, it is possible that they will be manufacturing the complete engines themselves.

The Metropolitan Life Insurance Company has lent the services of William J. Barrett to the government for organizing a National Commission to combat future depression and allay their suffering. This commission was formed at the special request of President Hoover, and we are sure that Bill will be able to lay the ground work to prevent future catastrophes, such as we have with us at the present moment.

Irving McDaniels, after many years, has finally returned to the United States from the Far East. He is now located at the Brooklyn Navy Yard, Brooklyn, N. Y. — Milton Schur writes that the publicity given him in the December issue of The Review has resulted in some of his friends writing him at Berlin, N. H. Milton is in the research department of the Brown Company, and he is particularly engaged in directing research in the utilization of new pulps being developed by his company. His address is 300 Church Street, Berlin, N. H.

H. W. Ellis is with the General Electric Lamp headquarters at Nela Park, Cleveland. H. W. occupies a very important position in the lamp industry of this country, for it is really on his say-so that production is controlled in all of the General Electric Lamp factories. He schedules production throughout the several factories and apparently has his fingers very closely on the lamp situation.

Edward R. Hall has changed his address from Fort Wayne, Ind., to Baltimore Club, Baltimore, Md. — Edgar F. Hanford is now located at 611 Hohman Avenue, Hammond, Ind. — Allen D. Pettee is now located with the General Cable Corporation, 20 No. Wacker Drive, Chicago, Ill.

Anyone know the correct addresses of the following from whom mail has been returned: John N. Burford, 106 Birr Street, Rochester, N. Y.; John L. Mullin, Gambel-Robinson Fruit Company, Bemidji, Minn.; Mrs. Marie I. Taveau, 242 W. Jersey Street, Elizabeth, N. J.? — HENRY B. SHEPARD, *Secretary*, 269 Highland Street, West Newton, Mass. CHARLES W. LOOMIS, *Assistant Secretary*, 7338 Woodward Avenue, Detroit, Mich.

1917

These notes were written in the midst of the busy holiday season after considerable pressure had been brought to bear on the Secretary by the staff of The Review. The material for them consists of four brief documents, all referring to an intended visit to Boston of one L. L. McGrady of the Eastman Kodak Company, Rochester, N. Y. The most significant is a telegram addressed to Harrison P. Eddy, Jr. "Forced to change plans. Regret not seeing you. Cheerio — Mac."

Presumably, Mr. McGrady intended a World Conference on the Fifteenth Reunion of Class of '17 at the Corinthian Yacht Club next June but, for some reason, his trip was postponed.

Anyone know the correct addresses of the following from whom mail has been returned: Dudley E. Bell, c/o The Bell Nutter Mfg. Co., 10th & Allegheny Ave., Philadelphia, Pa.; Irving Fineman, c/o Nat'l City Bank, 41 Blvd. Haussmann, Paris, France; Vincent Panettiere, 297 Garfield Pl., Brooklyn, N. Y.; Walter A. Wood, 48 W. 55th St., N. Y. C.? — RAYMOND STEVENS, *Secretary*, 30 Charles River Road, Cambridge, Mass.

1918

Contact, the official organ of the New England Power Association, in its December offering, carried a picture of Erving G. Betts — horn-rimmed glasses, von-Hindenburg haircut, an' everything. Erving breaks into the news as district power sales engineer with headquarters in Northampton, Mass. He says in his response to our cablegram for news that his sales resistance to our entreaty is not as good as that of some prospects he tackles. Polite bows from us. We bet a second-hand synchronous converter that he doesn't sell Cal Coolidge a kilowatt for all his having once been a heavy-artillery captain working for John Pershing.

Returning from a long and hazardous hour with our one o'clock class in Humanics, we found a breezy and refreshing greeting from Art Windel, penciled on a gleaning from our waste basket. The note promised his return, but the happy meeting has not yet transpired.

For those who still have the January notes available, be it known that the exuberant dinner, held in Greenwich Village by some of the brethren, took place in what was once a coal bin. Nor had the management spent much in fixing it up. Maybe the coal dust put B.T.U.'s instead of mere calories into the grub. Anyhow, a hot old time was had by all. More anon.

Anyone know the correct addresses of the following from whom mail has been returned: Elwood M. Manter, Williamson School, Delaware County, Pa.; Walter H. Robertson, 50 Church Street, New York City? — F. ALEXANDER MAGOUN, *Secretary*, Room 1-305, M. I. T., Cambridge, Mass. GRETCHEN A. PALMER, *Assistant Secretary*, The Thomas School, The Wilson Road, Rowayton, Conn.

1920

The spotlight at this writing is on Harold Bibber, or perhaps we should say Professor Harold Bibber. For the past two years Harold has been an engineer at the General Electric Company's Schenectady plant. He has recently had the honor of being appointed Professor of Electrical Engineering at Ohio State University. Since graduating, Harold has resided in France and in Japan. He will take his post at Columbus, Ohio, as one of the youngest professors yet appointed at that institution.

Johnnie Nolen has also attained the limelight since our last notes by being appointed City Planner to the Park and Planning Commission of Washington, D. C. Johnnie has been with the Tri-State Regional Planning Body in Philadelphia. He has won quite a reputation in this kind of work, having been associated with Fay, Spoffard & Thorndyke in creating the model town of Mariemont, Ohio, and also done planning work at Sarasota, Florida.

A marriage of note is that of Frederick James Hopkinson to Miss Margaret Jane Lamb of Columbia, Tenn., on October 6. Hopkinson is connected with the Chemical Engineering Department of the Eastman Kodak Company. His new home will be at 1410 Monroe Avenue, Rochester, N. Y.

The announcement of the engagement of Johnnie Rockefeller to Miss Mary Brooke of Newark, N. J., has been published as of November 12. The Class congratulates you, John.

Jim Downey has left the South and is now living in Woodbury, N. J. — Reg Burr is with the McGraw-Hill Publishing Company at their St. Louis office. — Ed Bragg is now living in Scarsdale, New York.

A welcome Christmas card from Bunt Murphy indicates that Mr. and Mrs. Murphy are now residing at 236 Collins Street, Hartford, Conn. Another from John Chester Wilson, otherwise known as Woodie, indicates that the address of Mr. and Mrs. Wilson is 8020 First Avenue, N. E., Seattle, Wash. It was certainly pleasant to hear from this long-lost classmate. — Bud Cofren was married December 11 to Eugenia Hodges. This is great, not to say startling, news. The Class joins me in extending heartiest congratulations.

Anyone know the correct addresses of the following from whom mail has been returned: Waldo H. Brown, 40 Belle Island, Miami Beach, Fla.; Albion N. Doe, 37-46-85th St., Jackson Hts., N. Y.; Arthur Grosscup, 315 Pearl St., Hartford, Conn.; Louis B. Harris, P. O. Box 358, Wilmington, Del.; Ming Hsin Pai, 4 Yuen Ming Yuen Rd., Shanghai, China; William H. Schimmelpfenning, Henry Barracks, Cayey, P. R.; James J. Wolfson, 751 Walton Ave., Bronx, N. Y.? — HAROLD BUGBEE, *Secretary*, 7 Dartmouth Street, Winchester, Mass.

1921

Our heartiest congratulations to Mr. and Mrs. G. Everett Farmer on the arrival, November 18, 1931, of Master Allen Thompson Farmer. Gef is Supervisor of Communication Design for the Southern California Edison Company of Los Angeles and makes his home at 132 North Carson Road, Beverly Hills.

A recent marriage of interest is that of Miss Bernice Vadney, daughter of Mr. and Mrs. J. C. Vadney of Alplaus, N. Y., and Lincoln B. Barker, son of Mrs. H. H. Barker of Canisteo, N. Y., which took place in the parsonage of the Bottskill Baptist Church, Greenwich, N. Y. Linc is connected with the General Electric Company at Schenectady in the Works Laboratory. He and his bride are making their home in Alplaus. In communicating the above, Ray's comment is, "Some folks take a long time to get married but most of us do eventually, — bachelors please note."

Harold Levin is director of a research group with the Flintkote Company with headquarters in Rutherford, N. J., where he has been located for about eight years. Harold was married a number of years ago, — no family but a dog!

Ques. — What is Tappi? Ans. — It is what Ronald Macdonald is Secretary and Treasurer of; address, 18 East 41st Street, New York, N. Y. After diligent and exhaustive study we have deciphered it by means of the New York telephone directory as standing for the Technical Association of the Pulp and Paper Industry. This eminent Tappite, who, by the way, is a recent benedict, reports seeing A. E. Bachmann when out in Wisconsin last fall. Red is assistant superintendent of one of the Kimberly Clark Company mills at Neenah, Wis.

Ray reports meeting Arnold C. Rood in Boston last December. Ace has recently come East from Cleveland and is now a patent lawyer with the United Shoe Machinery Company in Boston. He is married and lives in Wellesley.

Herbert A. Kaufmann is still with Stein, Hall and Co., manufacturing chemists, 285 Madison Avenue, New York, N. Y., where Herb is director of the technical service department. More news of him if and when our proposed lunch date materializes.

Lawrence W. Conant is President of the Biltwell Chair and Furniture Company, Denton, N. C. Larry reports that for four years after graduation he was with F. H. Conant and Son of Camden, N. J., following which he was in Rochester for a year with Hubbard, Eldridge and Miller. Then he went to High Point, N. C., where he was a consultant for a year before purchasing the Biltwell Company. He has recently developed the "Ko-Rect Posture Chair" which is a specialty product rather than strictly furniture. Larry has three fine youngsters: Bill, 6 years old; George, 4; and Peggy, 2.

How about your New Year's resolution to write to your Secretaries? Do it now!

Anyone know the correct addresses of the following from whom mail has been returned: Abraham M. Aronson, 239 Fowler Ave., Jersey City, N. J.; Andrew M. Bell, Frankfort, Ky.; Dr. Harry E. Hitchcock, General Delivery, New Haven, Conn.; Karl Jetter, 608 City Hall, Asheville, N. C.; Kuo Chou Li, Peking Suiyuan Railway, Nankow, Neai, Peking, N. China; Theodore A. McArn, 207 Greene Ave., Aurora Hills, Va.? — RAYMOND A. ST. LAURENT, *Secretary*, Rogers Paper Manufacturing Co., South Manchester, Conn. CAROLE A. CLARKE, *Assistant Secretary*, Bell Telephone Laboratories, Inc., 463 West Street, New York City.

1923

During December I was in Pittsburgh and, in company with Howard Dexter, VI, attended a meeting of the local Technology Club. There were about 26 present to hear Colonel Burrill, who with Bradley Dewey '09, organized the Chemical Warfare Service during the World War, tell of his experiences in Russia in connection with his work assisting in the development of the petroleum industry there. The meeting may be reported elsewhere in this issue. I was impressed with Colonel Burrill's conclusion that, while there was much in the new Russian scheme of things to which he could not subscribe, he believed that from the experiences of the Russians, who are applying entirely new methods of approach to various human problems, the rest of the world is undoubtedly likely to learn much.

Had just a brief visit in Charleston, W. Va., with Kibbe Turner, X, who is with the Carbide and Chemicals Corporation assisting in the operation of a new plant for the manufacture of butanol. Spent part of Saturday afternoon in Washington with George Southard, XV, who is with the U. S. Patent Office. We drove down to Fort Humphreys and called on Scoop Reinhardt '24 who was associated with us on *The Tech*.

Announcement has been received of the birth of a daughter, Jule Anne, to Hap Hazard, II, on November 4.

The annual Dinner Dance of the Classes of 1923, 1924, and 1925 in New York City is scheduled, as these notes are written, for February 6 at the Army and Navy Club. This party has been very popular and well attended in late years and a committee on arrangements has directed its efforts to develop a satisfactory program and to keep the price of the affair as reasonable as possible.

Pete sends in the following additional items: Howard Keppel, II, is associated with the Research Corporation in New York making studies in connection with the development of the "Cottrell Process" (whatever that is). Sam Williams, II, is back in the New York Office of the Westinghouse Air Brake Company after having been at the Company's Pittsburgh Plant for several months.

Art Stuckey, I, and Bobbie Burns, I, are both with Stone and Webster engaged in directing the construction of a dam at Eldon, Mo., according to a letter from the latter. — Bob Shaw, VI-A, is now connected with the Museum of Science and Industry in New York City.

This year our class representative to the Alumni Council comes up for election. This job has been handled since graduation by Kitty Kattwinkel, XV. Under the stress of his internship and getting the business of a budding medical practice started, he has not had the time he would have liked to give to this. Following advices from Pete Pennypacker regarding the sentiment of some of those in New York, and after conferring with Kitty, Vice-President Doc Smith and Bob Hendrie in Boston, it was decided to advise Professor Locke to put Bob Hendrie's name on the ballot this year. We hope this action will be acceptable and will be approved by the Class at election time.

Our Treasurer, Red Adams, XV, who has been with the Massey-Harris Company in Paris for several years, is back in this country at Berwick, Pa. Other address changes reported include: Charles C. Henry, VI, from Chicago to South Bend, Ind.; Lt. Martin H. Burckes, I, from Hawaii to Fort Hoyle, Md.; and Frank S. Archer, X, from Snyder to Rochester, N. Y. — HORATIO L. BOND, *Secretary*, 31 Concord Avenue, Cambridge, Mass. JAMES A. PENNYPACKER, *Assistant Secretary*, Room 661, 11 Broadway, New York City.

1924

The third annual dinner dance of the classes of 1923, 1924, and 1925 will be held Saturday, February 6, 1932, at the Army and Navy Club, West 44th Street, New York City. Invitation is extended to all members of these classes and those not receiving one may communicate with Bill Correale at 840 Mott Avenue, New York City. — HAROLD G. DONOVAN, *General Secretary*, 372 West Preston Street, Hartford, Conn.

1926

In the last month, the three clipping services hired by the Institute have not gleaned a single item about members of this rapidly aging class, not even a marriage, birth, or crime. And so, gentlemen, we can do little else but exult in the Course XV notes that Mooney Owen presents below. He has been applying Sears, Roebuck mail order technique to the collection of class notes, and with a huge degree of success as you must admit. He has sent in so much material that a portion of it must be held for next issue.

Eagle-eyed members of the Class no doubt observed the photograph on the contents page of the December Review, and the credit line "Rosser" beneath it. This is none other than Barnard P. Rosser. He has been working on the Kill van Kull Bridge and had an opportunity to take numerous photographs of that record-breaking arch — photographs that were good enough, we may say with a certain amount of archness, to crash the

1926 Continued

pages of this estimable boys' magazine. If other members of the Class can come up to Rosser's standard, they are earnestly solicited to submit prints.

Harry ("Spark Plug") Boardman was in the office just prior to the Christmas vacation. He is still with the Champion Spark Plug outfit and he was in New England as a sales ambassador of his company.

Anyone know the correct addresses of the following from whom mail has been returned: Douglas P. Jeppe, Varnville, South Carolina; Prof. Po King, Univ. of Nanking, Dept. of Physics, Nanking, China; Samuel McMurtrie Morgan & Co., Place Vendome, Paris, France; Dr. Chia W. Ou, 26 Clinton St., Cambridge, Mass.; William W. Peterson, 132 Sumac St., Philadelphia, Pa.; Francis R. Van-Buren, 414 Masonic Temple, New Orleans, La.; Leonard Vexler, Tech Club, N. Y. C.; William A. Williamson, A. P. Green Fire Brick Co., Mexico, Missouri; Samuel W. J. Welch, Morganton, South Carolina? — J. RHYNE KILLIAN, JR., *General Secretary*, Room 11-203, M. I. T., Cambridge, Mass.

COURSE XV

Old Man Depression — What he hasn't done to Course XV! He has completely floored about 80% of the Course from all indications, as many were unable to take advantage of the "free postage offer" due to their lack of funds with which to secure stationery, pen and ink, or pencil.

Bob Richardson says that Old Man Depression has taken a good wallop at him. However, he is still on his feet, and is working for the E. Stanley Wires Company, Inc., in Boston. Just at present, he is in charge of, and has been for the past year, their Water-proofing Department. Bob was married two years ago last May and has a husky boy, Bob, Junior, 18 months old.

From Frankfort on the Main, Germany, comes a letter from Fred Walch, who is still representing Dewey and Almy Chemical Company in France, Switzerland, Belgium, Holland, and Spain. Fred hopes to get to America *some time* this coming spring. He reports having seen Bean Lambert and his lovely wife in Paris and "how he enjoyed it (them)," he says.

The depression has hit Nathan Pearlstein so hard that he had to go out and hire a hotel room in order to get stationery to answer my letter. He was married two years ago last September to Miss Deborah Simons and as yet has not acquired a family, "praise be," says he. He is working for Cluett, Peabody, Inc., and is doing santorizing engineering on the side.

Maurice Ash is still with W. H. and L. S. Betz Company of Philadelphia in the capacity of their mid-western manager in Chicago. They offer a chemical service for power plants. Ash reports business very slow and wishes to start a course XV Bachelor's Club as he has either lost all hope of acquiring a wife, or has forsworn the matrimonial state. During the past summer, he was down to the Rock Island Arsenal and received his first lieutenant's commission in the reserve corps. His brother, Ed '22, and Al Nevers '27 were also there.

Dick Chapin seems to be quite sold on the Puget Sound country. He is still with Frederick and Nelson in Seattle in the capacity of Building Superintendent. Chuck Flohr '27 is also in Seattle, being with the Washington Survey and Rating Bureau. Dick saw "Paco" de La Macorra '24, who was in Seattle recently looking over the lumber situation in regard to the possibility of purchasing some pulp wood for his father's paper mill in Mexico. Ed Burgess and his wife spent a few weeks in Seattle, while Ed was helping to install certain machinery on a number of cruisers at the Navy Yard.

What Ho! A letter from Jim Killian, who says he is married and perhaps dead and hibernating, too. As everyone knows by this time, Jim has a little daughter. Incidentally, he is making quite a reputation with The Review.

Cedric Thompson reports that he was married the latter part of 1928 to Miss Mildred Cannell and now has a young son, Cedric, Junior, who was born the early part of 1930. Incidentally, Thompson expects his husky offspring to be a football star, particularly since he will have the tutelage of his uncle, head football coach at Dartmouth. Thompson is with Welburn Cadillac Company, Malden, Mass., in the capacity of office manager and accountant. He recently saw Al Willis, who has just quit selling life insurance for the Metropolitan Life Insurance Company, and also George West, who is now located in Pennsylvania.

Al French informs me that he is one of those staunch old veterans of the Class of '26 who has remained single. He is at a complete loss as to the cause and reports that he is seriously thinking about joining one of those "Blue Beard Marital Organizations and seeing what a little advertising in the *Police Gazette* might do." Al is connected with the French Oil Mill Machinery Company at Piqua, Ohio, making all types of industrial hydraulic presses as well as cookers, and presses for extracting oil from vegetable oil bearing materials. He has been working around the various departments, spending the conventional year in overalls, and just at present is particularly interested in the selling and developing end of the business.

Don Hooper has had quite a varied experience since graduation, practically all of it being in the research field. Just at present he is manager of the Market Research Department of the Mohawk Carpet Mills, Amsterdam, N. Y. Immediately after graduation he was sales research assistant for the Eli Lilly Company of Indianapolis. He then organized a sales research department for Rust Craft Greeting Cards in Boston. On the strength of this he got married, but 13 (note the number) days after taking the job he was fired, and he reports that his stock at this time fell to its all time low. Under "Pop" Freeland he did some research work for a shoe manufacturer and then, strange to say, did the same thing for a Corset Company. He then journeyed to St. Louis to become director of research for a new advertising agency and upon his arrival found that the company had neither money nor accounts. Since that time, he has been with the Mohawk Carpet Mills. — This chronicle of the articulate 20% of the course will be continued next month. — THORNTON W. OWEN, *Secretary*, 940 Pleasant Street, Oak Park, Ill.

1927

A letter from Ernie Dodge, relayed to me some time ago by The Review office, and the Course I notes from Lee Miller are the principal bits of news that have come my way in some months. Ernie writes: "Frank Staples is married. Two weeks ago to a girl from Montreal. Now sailing the bounding main on his honeymoon. — Frank Pearson also stepped off about three weeks ago. — Freddie Bodden has a baby girl about three weeks old. — I was down in Philadelphia about three weeks ago and saw Charlie Sweet, who is married and has a baby boy about 13 months old. Also saw Paul Vaughn there. — Doug Donald has just been transferred to the Pacific Coast and will be in charge of operation of the new Transpacific radio telephone service, which begins about the first of the year and will furnish service between Hawaii and this country.

"Ran into Dick Cutts on Broadway not long ago. Working for G. E., married, and living in Westchester. — Lou Baker is now back to shipping business and is an officer of some kind on one of the South American boats. — Harry Dahl is now a man of leisure and spends most of his time off Montauk Point yachting with the naval forces. When not there, he is spending his time at the mountains in Vermont.

"Can't think of anything else right now. I am still with the Long Lines Department of the A. T. & T. Company. Like it."

Dave Knox is now living at 2329 Edgewood Boulevard, Berkeley, Royal Oak, Mich. A telegram received from him just as these notes are due wishes everybody a happy new year, but, he adds that "the fountain has run dry." Hence no news. How about it, you Course II men?

George Houston announced a new address some time ago: 27 Burnett Terrace, Maplewood, N. J. This is for the information of Course XV. — Christmas cards have been received from Howard Chinn, Ned Anderson, George Houston, Lee Miller, and Johnnie Collins. The latter's allusion to greetings from Jackie indicates that there are now three in the Collins family. Congratulations to Johnnie and thanks to all.

Jim Lyles is still with Harris-Forbes (now Chase, Harris-Forbes Corporation) in New York. — Stephen Gardner Crawford was born on September 14 shortly after we moved to a house on the Post Road in Wayland.

1927 Continued

Anyone know the correct addresses of the following from whom mail has been returned: Gordon L. Calderwood, 59 Fairfield St., Springfield, Mass.; Ole F. Christiansen, 8937 Euclid Ave., Cleveland, Ohio; Horace R. Dyson, 7 Pomona St., Springfield, Mass.; Julius Friedman, 213 17th Ave., Seattle, Wash.; Sidney Gerber, 124 W. 4th St., Los Angeles, Calif.; Elmo W. Landers, 27 New Ocean St., Lynn, Mass.; Tze-Chang Lee, Public Works, City Government of Nanking, China; Earl deW. Lissner, 137 Kensington Ave., Jersey City, N. J.; Francesco Marcucelia, 28 Gourly Rd., Medford, Mass.; Emory F. Patterson, 83 Emmons Blvd., Wyandotte, Mich.; Charles W. Snow, c/o Cutler Hammer, Inc., Ellicott Sq., Buffalo, N. Y.; John H. Wever, 39 Atherton St., Jamaica Plain, Mass.? — JOHN D. CRAWFORD, *General Secretary*, P. O. Box 89, Wayland, Mass.

COURSE I

I really haven't any fresh news from my gang. The last letter came from Carl Redd about a month ago. He was still down in West Virginia building a bridge, but expected to be finished soon. Mail will reach him if addressed to Peachburg, Ala. Many of the group sent Christmas cards and I wish to thank all who did.

Frequently I meet Technology men here in Syracuse. Maybe some of you know Jack Campbell. He is with the American Blower Company, and was transferred from Syracuse to Indianapolis, Ind. Jack was in the Class of '28. — Last week I was surprised to meet M. W. Bardwell, VI, '28. He is with the Syracuse Lighting Company. His address is 733 Euclid Avenue, Syracuse. — I am still with the New York Telephone Company and seem to be going strong. I've drifted away from engineering somewhat and am now in supervisory work.

You fellows who haven't written about yourselves for from one to three years — why not make a New Year's resolution and voluntarily send me a lot of information? I'm going to expect enough material to permit a write-up in each of the remaining Review issues this season. Will you do your part? — LEE MILLER, *Secretary*, 320 Nichols Avenue, Syracuse, N. Y.

1930

At last one of our classmates has come to the rescue of your Secretary and of his own free will and accord has sent in all the news of the class that he has. His letter certainly was welcomed with open arms and I hope that now that someone has started the fashion some of the other members will keep up the good work.

Yicka's letter contains the following information. "The hottest piece of news that I have is that Ernie Fell is married. Poor Ernie, he used to be a good scout too. . . . They said Ernest is working for the American Printing Co., and is living at 559 President Ave., Fall River, Mass.

"George Ernest Barker is still brown bagging at the Institute. I wrote to him a while ago and received an answer yielding little if any general information. In other words a typical Barker letter. . . . Dick Barry is engaged in the dyeing business . . . in North Adams." — Yicka also gives a short résumé of his work since graduation and ends by stating that he is at present working for the Viscol Co., in Cambridge.

We recently had a very pleasant surprise in the form of a visit from Mr. and Mrs. Allen Stone. Allen is now working in Buffalo.

We also have news of the engagement of Joe Harrington and Miss Alene Louisa Smith of Stamford, Conn. No date has been set for the wedding.

Anyone know the correct addresses of the following from whom mail has been returned: Charl D. Cillié, 92 Revere St., Boston, Mass.; Jesse Coates, 420 Memorial Drive, Cambridge, Mass.; Gilbert L. Cox, 78 Peterborough St., Boston, Mass.; Charles E. Hughes, 255 W. 39th St., N. Y. C.; Daniel J. Hughes, 9 Florence Ct., Babylon, N. Y.; William J. Moody, 397 Commonwealth Ave., Boston, Mass.; Harry W. Poulos, 73 Westland Ave., Boston, Mass.; Edwin R. Rowzee, M. I. T.; Miguel A. Sastre, Tech Dorms, Cambridge, Mass.; Philip Torchio, Jr., 12 N. Ferry St., Schenectady, N. Y.; A. A. Yakovlev, c/o Krisanfo P. App 30 16 N. Lubronka, Moscow, U. S. S. R.? — MORELL MAREAN, *General Secretary*, 1239 Norwood Avenue, Niagara Falls, N. Y.

1931

Engagements: Miss Phyllis Markey, daughter of Mrs. Frederick S. Markey of Berkeley, Calif., to Frank D. Matthews. The bride-elect is a senior at the University of California. — Miss Phoebe Adams daughter of Mr. and Mrs. Earl Adams of New Haven, to Arthur K. Wing, Jr. Miss Adams is a member of the Class of 1932 at Smith. — Miss Hilda C. Sherey of Jamaica Plain, Mass., to Harry D. Kamy.

W. Chester Cornell of Braintree announces the marriage of his daughter, Miss Cora Thayer Cornell, to Clifford Charles Walker. Mrs. Walker is a graduate of the Lasell Academy at Auburndale and of schools in Germany and Switzerland.

David Ericson sailed to France after graduation, thence to Italy with his parents, where he visited Capri and Vesuvius, as well as some large Italian volcano. At present he is seeking a position in Paris.

In looking over the recently published student directory for the current Institute year, it is interesting to note that 73 of the names listed as students have thereafter affixed "S.B. Massachusetts Institute of Technology 1931." Additional data will be furnished to any member of Course IX who would be willing to calculate the percentage of the graduating class returned for further study.

Anyone know the correct addresses of the following from whom mail has been returned: Philippe H. Bonnet, 23 Warren Ave., Boston, Mass.; Edmund G. Caine, 454 Nahatan St., Norwood, Mass.; Benjamin F. Clark, Jr., M. I. T.; Ciriaco I. Coronel, 34 Mass. Ave., Suite 6, Cambridge, Mass.; Edward Depoyan, 86 Green St., Brockton, Mass.; Laurence G. Hicks, 9 Winthrop Hall, Cambridge, Mass.; Milton W. Krause, La Grange, Texas; Vladimir A. Semion, 51 Queensberry St., Boston, Mass.; Myron L. Williams, 11 Hope St., Dorchester, Mass.? — JAMES B. FISK, *General Secretary*, 4 Story Street, Cambridge, Mass.

COURSE III

The following account was sent in by one of the members of Course III: I believe it will be of great interest to the Class to include some remarks on the doings of Course III. Those men who were fortunate enough to obtain positions are located far from one another. Bob Backus, who has been working for the Braden Copper Company in Chile, has returned to Nantucket.

Gifford took the fatal step in June and is now happily married. He is assisting the metallurgical department of the Illinois Zinc Company. Gif evidently has the makings of a metallurgist as indicated by his thesis on "The Free-fall Roasting of Pyrite." His partner in the production of that masterpiece, however, has returned to the Institute to bless the Mechanical Engineering Department with his presence. Egg intends to take an S.B. in this course next year. This should put him far ahead of his old classmates of Course III. The drafting experience he obtained under dear old Ebbie will come in handy now.

Sherman is with the Philadelphia and Reading Iron and Coal Company as a general man. At the present time he is studying the effect of drawing on dilution with the aid of models. Reports have it that Sherman is delighted with working in Pennsylvania since he can keep in touch with dear old Brass Teeth of mining camp fame. He is probably making the best of his good fortune.

Gibbs has just begun laboring for the same company which employs Sherman. By a stroke of luck Gibbs obtained an interview with the Vice-President, who is an old Technology man. Well, you know, we Technology men must stick together.

With regard to the other men, Mulliken has, to all appearances, disappeared from the face of the earth. Tony and Fitzi are striving for their master's degrees, having been unsuccessful in obtaining any satisfactory position. Don Herbert is following in the steps of Doe and appears to be destined for a professorship within a few years. — ROBERT S. BACKUS, *Secretary*, Wauwinet, Nantucket, Mass.

COURSE VI

We have a little more news at hand for this issue of The Review due to a very newsy letter received from Bob Vanderworker. He did radio service work this summer and recently took a job in a cotton mill. We wonder how many Course VI grads are doing electrical engineering right now.

1931 Continued

Van says he heard a rumor to the effect that Henry Hartwell is working for the Pilot Radio Corporation in Lawrence. How about it, Henry? Van also had hopes of a job there, but it fell through. — MacNevin and Smith are both looking for jobs, as is Franklin Zwicker.

A card from Roger Wilson arrived from San Francisco. He is going to the Philippine Islands, and reports that Fred Elser is going to be married on February 6. We wish him lots of luck. Fred, we think, is at Stanford University getting an M.S.

Earl Cullum is not, as was stated in the last report, at M. I. T. Texas evidently proved too much for him and he is still there. — The story of Cliff Harvey, who was looking for bread lines, old clothes, and sympathy, is funny because despite the fact he is or was looking for a job, he has been making more money than a good many other Course VI men who are regularly employed. He has been building radio transmitters and is now finishing up a 500-watt telephone transmitter.

It is rumored that Louis Stander is working in Detroit in a hydroelectric plant. This was his most detested subject at M. I. T.!

Your course secretary is now working on a research problem connected with acoustics, and is also doing a little high-frequency radio work on the side. Luckily this job presented itself immediately after the Cape Cod job stopped, with time for a short White Mountain trip in between. Present headquarters are Newton and Wellesley, Mass., but anyone wishing to send any information for future Review news, please use the Haverhill address. — JOHN N. DYER, *Secretary*, 30 Columbus Avenue, Haverhill, Mass.

Technology Club of Milwaukee

The Club resumed its monthly informal dinner meetings this fall with a dinner at the Colony Inn on the evening of November 17. Principally because of a heavy rain which drenched the city that evening, not a very large crowd was present. Six loyal souls turned out, however, to enjoy our first dinner.

The December meeting was held Tuesday evening, December 8. As usual, we had the "Tavern," a private dining room at the Colony Inn for the evening. Eleven men sat down to dinner. This meeting brought out many of the old timers whom we have been accustomed to see at these dinners as well as one or two new faces. Edwin L. Smith '05, one of the Club's old standbys, put in his appearance. He had not been seen at our dinners for some time. We were glad to welcome Ralph E. Boeck '28, who attended one of our meetings for the first time.

There has been some talk of organizing a bridge or bowling party some time during the present season. Plans for this will be discussed at the January meeting which is to be held January 5.

During the past summer, Armand D. Koch '92, one of the older members of the Club, passed away. His death, which occurred on August 5, was mourned greatly in this city. — MAURICE D. JAMES, '27, *Secretary*, 1713 North Prospect Avenue, Milwaukee, Wis.

Technology Club of Southern California

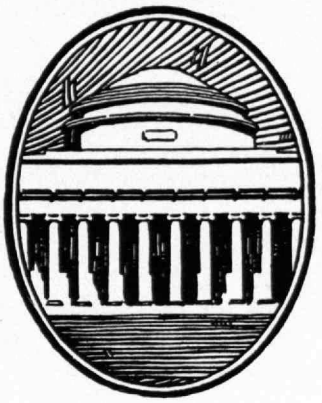
A dinner in honor of Dr. James L. Tryon was held on November 30 at the University Club of Los Angeles. Our President, Robert S. Breyer '10, acting in behalf of the Club, welcomed Dr. Tryon to Los Angeles. Dr. Tryon gave a most interesting talk telling first the purpose of his various tours about the country, of the friendliness of the receptions he had received everywhere and the benefit which he hopes and expects will accrue to Technology because of his efforts. The second portion of his talk covered the interesting story of recent development and progress at Technology.

President Breyer thanked Dr. Tryon and in a brief talk expressed the desire that he carry back to headquarters the message that we of the Southern California group will do our part in promoting the best interest of Technology in the far West.

Some of those present were: Richard W. Lodge '79, Raymond B. Stringfield '15, Elmer C. Strayer '23, George L. Davenport, Jr. '06, C. Clarke Keeley '29, Van Court Warren '10, John R. Brittain '93, Russell W. Conant '23, Harry G. Folsom '01, Alfred F. Rosenheim '81, John K. Heller '16, Robert S. Breyer '10, Edward P. Dean, F. B. Filbrick, Gordon F. Rogers '28, George H. Clapp '03, Henry L. Gardner '14, Prentiss I. Cole '27, Melville C. Wilkinson '91, J. Kendall, Lyman Parnell, M. F. Graupner '12, Rolf R. Newman '03, Milton L. Fish '95, Kenneth D. Kahn '15, Kenneth C. Kingsley '23, D. H. McCreery '22, L. G. Weld '02, Edwin K. Chase '06, L. E. Clark '25, and Henry B. Dean '28.

It has been a great pleasure to have Dr. Tryon with us. We hope that he has enjoyed his visit with us and will come back again soon. — HENRY B. DEAN, '28, Union Oil Company of California, 617 West 7th Street, Los Angeles, Calif.

RUMFORD PRESS
CONCORD, N. H.



INFORMATION

THE TECHNOLOGY REVIEW BUREAU exists to supply authoritative information to anyone interested in details regarding the Massachusetts Institute of Technology. It serves as a clearing house for inquiry and aims to further the spread of exact information regarding entrance requirements, outline of courses, subjects of instruction and other information which may be of aid to the students considering undergraduate or graduate study at the Institute.

The Institute publishes a variety of bulletins, fully descriptive of individual courses, as well as a catalogue of general information essential to the entering student. The Technology Review Bureau will be glad to send, gratis and post free upon request, one or more copies of any publication listed below, or to forward any special inquiry to the proper authority.

Ask for the following circulars by their descriptive letters:

AB: For general information, admission requirements, subjects of instruction, ask for Bulletin AB.

C: For announcement of courses offered in Summer Session, ask for Bulletin C.

D: For information on Advanced Study and Research Work, ask for Bulletin D.

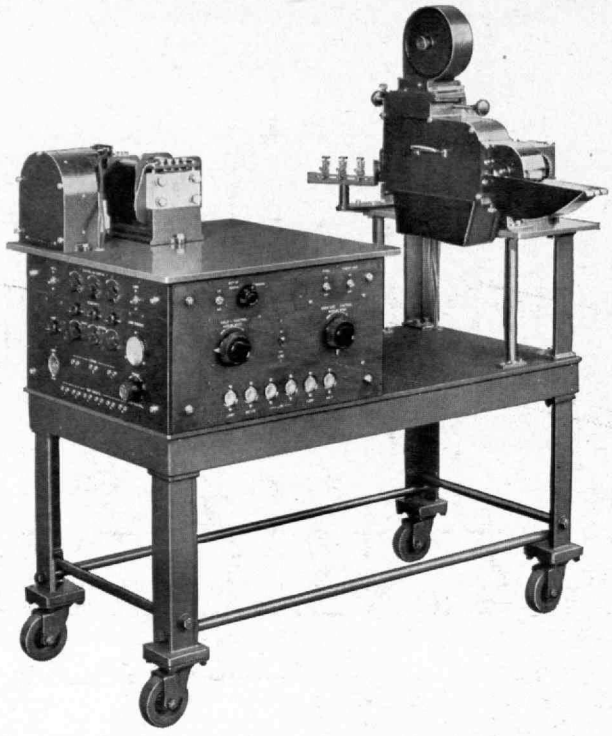
E: For the reports of the President and of the Treasurer, ask for Bulletin E.

Y: For a popularly written explanation of Engineering Courses, ask for Bulletin Y.

All inquiries sent to the address below will receive prompt attention

THE TECHNOLOGY REVIEW BUREAU

ROOM 11–203, MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS



AN OSCILLOGRAPH THAT DEVELOPS ITS OWN RECORDS

An oscillograph shows what is going on in an electrical circuit. It tells the observer how the current changes with time and traces out a record of phenomena, the total duration of which may be a fraction of a thousandth of a second.

Typical applications include the study of characteristics of telephone, telegraph, and submarine cable telegraph systems; measurements of vibration in machinery; and the analysis of heart ailments utilizing the electrical potentials set up in the cardiac muscles.

The General Radio has just completed development on an interesting and important 3-element recording oscillograph which differs from others in the flexibility of its controls and in its self-developing camera. The camera has its own automatically-operated photographic developing equipment so that important records are available for inspection while the phenomena are being recorded. Increased operating speed and freedom from dark room worries are important factors.

Two of these instruments are available and inquiries are invited from laboratories interested in acquiring them. The price is $3000.00 each.

GENERAL RADIO COMPANY

CAMBRIDGE A, MASSACHUSETTS

GENERAL RADIO

COMMUNICATION-FREQUENCY MEASURING INSTRUMENTS